

TESORO VIEJO



**TESORO VIEJO MASTER
MUTUAL WATER COMPANY**

DESIGN STANDARDS

April 2016

Prepared by:
Tesoro Viejo Master Mutual
Water Company
7020 N. Van Ness Boulevard
Fresno, CA 93711

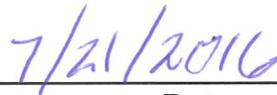
Keith Jolly, P.E.
District Engineer

PREFACE

MADERA COUNTY DEPARTMENT OF PUBLIC WORKS



Ahmad M. Alkhayyat, R.C.E. 67605
Public Works Director



Date

These Design Standards are found to be acceptable and/or meet the design criteria and standards of Madera County

MADERA COUNTY FIRE PREVENTION FOR LAND DEVELOPMENT

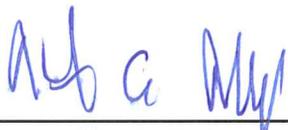


Deborah Mahler
Fire Marshal/Deputy Director



Date

TESORO VIEJO MASTER MUTUAL WATER COMPANY



Keith A. Jolly, P.E. 82923
District Engineer



Date

TESORO VIEJO MASTER MUTUAL WATER COMPANY
DESIGN STANDARDS

TABLE OF CONTENTS

SECTION 8 – DOMESTIC WATER SUPPLY SYSTEM DESIGN

8-1 INTRODUCTION	W 1
8-2 DESIGN CRITERIA	W 1
8-3 CURRENT STANDARDS	W 1
8-4 WATER SUPPLY QUALITY	W 1
8-5 WATER SUPPLY PRESSURE	W 1
8-6 FLOW DETERMINATION	W 2
8-7 PEAKING FACTORS	W 2
8-8 REQUIRED FIRE FLOWS	W 2
8-9 LOCATION IN EXISTING STREETS	W 3
8-10 LOCATION IN UNPAVED AREAS	W 3
8-11 TRANSMISSION SYSTEM DESIGN	W 3
8-12 DISTRIBUTION SYSTEM DESIGN	W 4
8-13 WATER MAIN LOCATION	W 6
8-14 VALVES	W 8
8-15 HYDRANTS AND BLOW-OFFS	W 9
8-16 WATER SERVICES	W 10
8-17 RESTRAINT	W 11
8-18 WORK NEAR EXISTING WATER MAINS	W 11
8-19 WATER IMPROVEMENT PLAN REQUIREMENTS	W 12

SECTION 9 – SANITARY SEWER DESIGN

9-1 DESIGN CRITERIA	SS 1
9-2 AVERAGE FLOW DETERMINATION	SS 1
9-3 DESIGN FLOW	SS 2
9-4 PIPE CAPACITY, SLOPE, VELOCITY, SIZE, DEPTH AND MATERIAL	SS 4
9-5 SEWER LOCATION AND ALIGNMENT REQUIREMENTS	SS 5
9-6 TRENCH LOADING CONDITIONS AND PIPE DESIGN	SS 7
9-7 MANHOLE CRITERIA	SS 8
9-8 DROP CONNECTION CRITERIA	SS 9
9-9 MAINLINE AND DIP TRANSITIONS	SS 9
9-10 SEWER SERVICE DESIGN	SS 9
9-11 CREEK CROSSING DESIGN	SS 12
9-12 BORING AND JACKING REQUIREMENTS	SS 13
9-13 PUMP STATION AND FORCE MAIN REQUIREMENTS	SS 13
9-14 SEWER IMPROVEMENT PLAN REQUIREMENTS	SS 15
9-15 MULTI-PARCEL COMMERCIAL AND INDUSTRIAL DEVELOPMENTS	SS 18

SECTION 10 – DRAINAGE

10-1 GENERAL	SD 1
10-2 TVMMWC POLICIES AND REQUIREMENTS.....	SD 1
10-3 DEVELOPMENT IN OR ADJACENT TO A REGULATORY FLOODPLAIN.....	SD 1
10-4 FEDERAL FLOOD PROGRAM	SD 2
10-5 DRAINAGE DIVERSIONS	SD 3
10-6 DRAINAGE EASEMENTS	SD 3
10-7 DRAINAGE CAPACITY/DESIGN.....	SD 3
10-8 DESIGN PEAK DISCHARGE METHODS.....	SD 4
10-9 HYDRAULIC STANDARDS FOR DRAINAGE SYSTEMS	SD 5
10-10 STREET INUNDATION REQUIREMENTS	SD 5
10-11 CLOSED CONDUITS.....	SD 7
10-12 MANHOLES.....	SD 8
10-13 INLETS.....	SD 8
10-14 JUNCTION BOXES	SD 9
10-15 INLET AND OUTLET STRUCTURES.....	SD 9
10-16 DRAINAGE PUMPS	SD 9
10-17 CHANNELS AND OUTFALL DESIGN	SD 10
10-18 CROSS CULVERTS AND BRIDGES.....	SD 11
10-19 DETENTION AND RETENTION BASINS	SD 13
10-20 ACCESS FOR MAINTENANCE.....	SD 13

SECTION 14 – RECYCLED WATER INFRASTRUCTURE DESIGN

14-1 DETERMINATION OF USE.....	RW 1
14-2 DESIGN INFORMATION.....	RW 1
14-3 CURRENT STANDARDS.....	RW 1
14-4 RECYCLED WATER SUPPLY QUALITY.....	RW 2
14-5 OFF-SITE RECYCLED WATER FACILITIES	RW 2
14-6 PRIVATE ON-SITE RECYCLED WATER FACILITIES	RW 2
14-7 WATER SUPPLY PRESSURE	RW 2
14-8 PEAKING FACTORS.....	RW 2
14-9 TRANSMISSION SYSTEM DESIGN.....	RW 2
14-10 SERVICE LINES	RW 6
14-11 ON-SITE RECYCLED WATER FACILITIES DESIGN.....	RW 7
14-12 DETERMINATION TO USE RECYCLED WATER OR POTABLE WATER	RW 11
14-13 DESIGN OF RECYCLED WATER FACILITIES WITH TEMPORARY POTABLE WATER SERVICE.....	RW 12
14-14 BACKFLOW PREVENTION DEVICES	RW 12
14-15 PROHIBITION AND LIMITATIONS.....	RW 12
14-16 CONTROL OF RUN-OFF AND APPLICATION AREAS.....	RW 13
14-17 MINIMUM DEPTH TO TOP OF ON-SITE RECYCLED WATER PIPING	RW 13
14-18 DATA REQUIRED ON PLANS	RW 14
14-19 LOCATION	RW 15
14-20 PLAN SUBMITTAL AND APPROVAL.....	RW 15
14-21 INSPECTION	RW 15
14-22 RECORD DRAWINGS.....	RW 15
14-23 CONTROLLER ACCESS	RW 16
14-24 BLOW-OFFS AND OTHER POINTS OF PUBLIC ACCESS.....	RW 16

SECTION 8

DOMESTIC WATER SUPPLY SYSTEM DESIGN

- 8-1 INTRODUCTION** – These improvement standards shall govern the engineering design of all domestic water systems intended for operation and maintenance by the Tesoro Viejo Master Mutual Water Company.
- 8-2 DESIGN CRITERIA** – These criteria shall apply to the engineering design of all water systems intended for operation and maintenance by the Tesoro Viejo Master Mutual Water Company. The intent of these criteria is to provide a water system that will dependably and safely convey high quality water throughout the distribution system.
- 8-3 CURRENT STANDARDS** – Pertinent and current requirements of the following agencies or standards shall be complied with. In case of conflicting design criteria, standards set forth by the Tesoro Viejo Master Mutual Water Company, as established herein, shall govern.
- A. United States Environmental Protection Agency (EPA) Drinking Water Regulations.
 - B. Laws and Standards of the State of California, Department of Public Health Services relating to Domestic Water Supply.
 - C. Tesoro Viejo Master Mutual Water Company Design Standards.
 - D. TVMMWC Code for taps to water system
 - E. Madera County Fire Code
 - F. Latest Edition of the American Water Works Association (AWWA) Standards.
- 8-4 WATER SUPPLY QUALITY** – The quality of water supplied to the TVMMWC's distribution system shall conform to the Environmental Protection Agency Drinking Water Act, and the State Department of Health Services Drinking Water Standards.
- 8-5 WATER SUPPLY PRESSURE** – Normal-operating pressures of not less than 25 PSI nor more than 125 PSI shall be maintained at service connections to the distribution system, except that during periods of peak domestic and fire demand, the pressure shall not be less than 20 PSI.

8-6 FLOW DETERMINATION – Determination of flow volumes required for a specific land use category shall consider maximum day domestic demands occurring in conjunction with an emergency fire flow demand. For design of the distribution system, the following unit demand factors shall be assumed.

Land Use Category		Average Day Unit Water Demand Factors
Residential	VLDR (<3.5 DU's/Ac)	600 gpd/DU
	LDR (3.5 to 7.9 DU's/Ac)	446 gpd/DU
	MDR (>8.0 to 12.9 DU's/Ac)	298 gpd/DU
	HDR (>13.0 DU's/Ac)	222 gpd/DU
Commercial/Other	Commercial/Retail	2,100 gpd/ac
	Business Professional	2,100 gpd/ac
	Light Industrial	3,049 gpd/ac
	Industrial	3,049 gpd/ac
	Elementary Schools	3,454 gpd/ac
	High Schools	4,068 gpd/ac
	Public (Fire Station, etc)	1,780 gpd/ac
	Park/Recreation	2,500 gpd/ac
	Open Space/Major ROW	-
	Agriculture	1,340 gpd/ac

8-7 PEAKING FACTORS – The average day demand to maximum day demand peaking factor shall be 1.42. The maximum day demand to peak hour demand peaking factor shall be 1.84 (2.61 average day to peak hour).

8-8 REQUIRED FIRE FLOWS – For areas of the general type noted below, the indicated water supply for fire flows shall be provided with the initial development. Expansion or change in zoning of the development shall be subject to the requirements of the California Fire Code (CFC hereafter) as adopted by the Madera County Fire Marshall (MCFM hereafter). The MCFM shall determine all fire flows.

A. Residential Areas – The fire flow demand for detached single family dwelling units shall be a minimum of 1,000 gallons per minute (gpm) in accordance with the CFC (for residential structures less than 3,600 SF). For fire flow greater than 1,500 gpm, each fire hydrant shall maintain 1,000

gpm or fraction thereof based on the provisions of the CFC.

Note: Automatic Fire Sprinklers – Single-family homes equipped with automatic fire sprinklers systems shall require a water service and meter as determined by the sprinkler plans and calculations. The water line shall start from the public main to the required water meter. Service size and meter size shall be as approved by the MCFM.

B. Multi-Family Areas – For attached multi-family units, the fire flow shall be determined by the Madera County Fire Marshall. The maximum fire flow shall be as referenced by the CFC.

C. Commercial, Business, Industrial or School District Areas – The maximum fire flow shall be determined by the Madera County Fire Marshall. The required fire flow however shall be as referenced by the CFC.

8-9 LOCATION IN EXISTING STREETS – Where water mains or services are to be located in an existing street, factors such as curbs, gutters, sidewalks, traffic conditions, traffic lane conditions, pavement conditions, future street improvement plans, and existing utilities shall be considered. The approval of the Madera County Public Works Director and TVMMWC Engineer shall be obtained in every instance.

8-10 LOCATION IN UNPAVED AREAS – All mains in unpaved areas shall be ductile iron pipe or PVC and marked every 150 feet with a blue 5-foot 6-inch composite utility marker. A decal shall be placed on the marker stating “CAUTION WATER MAIN.” Utility markers shall be Carsonite or approved equal with anchor barb kit. The first utility marker shall be placed within 20 feet of the public roadway.

8-11 TRANSMISSION SYSTEM DESIGN – Transmission mains are 16 inches in diameter or larger. Standard transmission main sizes are 16-, 24-, 30-, 36-, 42-, 48- and 54- inches in diameter. Sizing and layout of transmission mains shall conform to the Master Water Supply Plans of the TVMMWC Department.

Technical specifications for water transmission mains shall be a requirement of the proposed improvements plans. Under no circumstances shall fire hydrants or water services be directly connected to a transmission main, with the exception of hydrants that are acting as blow-offs.

A. Transmission Main Location – All transmission mains shall be installed within public rights-of-way and easements.

1. Mains shall be located 4 feet from the curb and gutter on the northerly and westerly side of the street. If conflicts exist at this location, then the main may be installed within an easement immediately adjacent to and behind the property line fronting the public right-of-way, subject to

approval of the Madera County Public Works Director and TVMMWC.

2. A minimum horizontal separation of 10 feet shall be maintained between sanitary sewer mains. A minimum horizontal separation of 4 feet and 1 foot vertical shall be maintained between recycled water mains carrying tertiary treated water. A minimum cover of 3.5 feet shall be maintained at all locations.
3. Transmission mains shall maintain a minimum vertical clearance of 1 foot from all other utilities.

B. Transmission Main Appurtenances

1. Valves shall be spaced no more than 2,000 feet apart.
2. Inspection manholes shall be placed every 1,500 feet. A minimum of one inspection manhole shall be located between two valves unless otherwise approved by the TVMMWC Director.

C. Corrosion Protection - A corrosion protection study shall be included with improvement plan submittals. Corrosion protection facilities shall be identified from the roadway with the curb stamp "CP- W".

8-12 DISTRIBUTION SYSTEM DESIGN – Standard distribution main sizes are 6-, 8-, 10, 12, and 14- inches in diameter. Sizes of mains shall be such that the stated normal pressures, as specified in Section 8-5, and the minimum requirements for main spacing, specified below, are maintained. The distribution system shall be designed in grid form to provide equalized pressures throughout the system equalized under varying rates and location of demand. The minimum pressures and flows specified in these design standards shall govern the design. The following shall be considered during system design:

A. Hydraulic Analysis – A Hardy-Cross network hydraulic analysis shall be provided to TVMMWC upon request.

1. The hydraulic analysis submitted shall include two copies of the following items:
 - a. The data input files, as well as the analysis results in electronic format.
 - b. Information on the proposed development (e.g. type of development, number of acres, number of units, fire flow requirements, etc.).
 - c. Data sheets outlining all assumptions (e.g. method used to assign demands to corresponding junction nodes and source HGL's used).

- d.** Map identifying pipe and node numbers and their locations.
 - e.** Fire hydrant locations.
 - f.** The name and version of software used for the analysis.
 - g.** Elevations of junction and source nodes. The elevations used in the network hydraulic analysis shall be based on a project grading plan or the anticipated final elevations. If the final grading plan deviates significantly from the elevations used in the analysis, a revised analysis will be required.
 - h.** Staging or phasing of the development.
 - i.** Appropriate off-site demands.
- 2.** The Hazen-Williams formula shall be used in the analysis of the system. The roughness factor shall be as follows:
- a.** $C=130$ for all cement-lined, PVC C-900/C-905, and ductile iron pipes greater or equal to 14 inches in diameter
 - b.** $C=120$ for all existing and new cement-lined, PVC C-900/C-905, and ductile iron pipes less than or equal to 12 inches in diameter
- 3.** When identifying the fire flow available in a network analysis, use the hydrant located at the development's weakest point (highest point in the development and/or last hydrant on a dead-end main). Also verify the hydrant is located at a junction node. The maximum delivery from any hydrant of the type conforming to current TVMMWC Standards shall be limited to 1,500 gallons per minute.

B. Pipe Sizes – The minimum pipe size for residential development shall be 6 inches in diameter. For commercial developments, the minimum pipe size shall be 8 inches in diameter.

C. Stubs – Stubs for future developments shall be ductile iron or PVC pipe originating from the water main.

8-13 WATER MAIN LOCATION – Water mains shall be installed in public rights-of-way or easements granted to the TVMMWC.

A. Location – The following horizontal and vertical criteria shall be used to locate water mains:

1. Mains shall be located 4 feet from the curb and gutter on the northerly or westerly side of the street. If conflicts exist, then the main may be installed immediately adjacent to and behind the property line fronting on the public right-of-way, subject to approval of the Madera County Public Works Director. Arterial streets may require dual mains, one on each side of the street, as approved by the Madera County Public Works Director and TVMMWC.
2. If it is necessary to install a water main outside of the public right-of-way, an easement dedication to the TVMMWC shall be required. Water mains shall be centered within their easement. Easements shall be located completely on one side of a property line or fence. Dedicated easements shall be clear of all permanent structures, building eaves, roof lines and the future trunks of large tree species. Temporary construction easements of adequate size shall also be provided. The easement width shall be the greater of the following:
 1. Minimum width of easement shall be 15 feet.
 2. All easements shall have a minimum width equal to the required trench width according to the standard detail for trench backfill plus 2 additional feet of width for every foot of depth of the pipe as measured from the bottom of the pipe to finished grade. All water mains shall be centered within their easement.
 3. Water mains located outside of paved area shall be ductile iron.
3. Water mains located between lots shall require an access easement or pedestrian walkway as determined by the Madera County Public Works Director.
4. Water mains shall maintain a minimum horizontal separation of 10 feet between sanitary sewer mains and 4 feet from recycled water

mains. All other utilities shall maintain a minimum 5-foot separation sidewall of pipe to sidewall of pipe. The water main shall be a minimum of 12 inches higher than sewer and recycled water systems. In cases where the water main must cross under a recycled water or sanitary sewer main or service, and with the permission of the TVMMWC Engineer, the water main shall be ductile iron to a distance of 10 feet on each side of the crossing with no joints. When crossing sanitary sewer force mains, the water main shall be installed a minimum of 3 feet above and be ductile iron a minimum of 10 feet on each side of the force main.

5. Water mains shall maintain vertical separation of 12 inches between storm drains and other dry utilities. The vertical clearance may be reduced to 6 inches with the approval of the TVMMWC Engineer.
 6. Water mains under large structures such as culverts and large diameter storm drains shall be ductile iron and installed within a casing per these standards. The casing shall extend beyond the structure a minimum of 5 feet or the depth of the water main on each side.
- B. Vertical Elevation Change** – Mains designed with a vertical elevation change using angle fittings shall use a segment of ductile iron pipe with an approved restraint system between the two angle fittings.
- C. Cover** - A minimum cover of 42 inches and a maximum cover of 60 inches shall be maintained as measured from the outside bell of the pipe to gutter flow-line for distribution mains. A minimum cover of 48 inches as measured above shall be maintained for transmission mains.
- D. Dead-End Mains** – Dead-end mains shall be eliminated wherever possible by looping the system. Blow-offs conforming to the Construction Standard details shall be installed on all permanent or temporary dead-end mains. Removal of the blow-off at the end of cul-de-sacs and service connection to the end of the main is not permitted without prior approval by the TVMMWC Engineer.
- E. Warranty Inspection of Water Main Stubs** - As a requirement, water stubs are provided to subdivisions as a courtesy by developers during the construction of backbone infrastructure in streets to prevent cutting up the newly paved streets when the subdivisions are ready to develop. These stubs become an integral part of the water system and subsequently the responsibility of the developers of the subdivision and are therefore subject to both construction and warranty inspections. This practice saves future developers construction time and cost that would have otherwise been spent on tie-ins and street repairs. Contractors will be required to test and repair these stubs, if found damage, prior to tie-ins. A note to this effect shall be

placed on the improvement plans.

F. Public Lines in Commercial Developments – Water mains shall be located within drive aisles unless otherwise approved by the TVMMWC Engineer. The Design Engineer shall minimize the length of District-owned mains where on-site water loop is required.

8-14 VALVES – Sufficient valves shall be provided on water mains to minimize customer service interruptions and sanitary hazards during repairs and future development.

A. Locations – Valves shall be generally located as follows:

1. No single shutdown will result in shutting down a transmission main.
2. At minimum intervals of 500 feet in school, commercial, industrial, or multi-family residential developments.
3. In residential areas, valves shall be spaced such that no single shutdown will result in shutting off water to more than 40 services or 1,500 feet of water main, whichever occurs first.
4. Valves shall be located such that any section of main can be shut down without going to more than four (4) valves to shut down the section main.
5. All tees shall have a minimum of one valve.
6. All crosses shall have a minimum of two (2) valves.
7. Valves shall not be located in street gutters, valley gutters, or driveways.
8. A valve shall be installed on each side of all bridge, major highway, or as required by the Madera County Public Works Director and the TVMMWC Engineer.

B. Removal and Abandonment – Any valve outlet installed prior to lot development and subsequently not required shall be removed in its entirety. If removal is not practical, the valve shall be abandoned in the closed position and the lateral shall be cut, capped, and finished with an adequate thrust block. The lid shall be welded shut and painted red. The following note shall appear on the construction drawing:

The Contractor shall cut the existing pipe where shown on the drawing and install a restrained cap complete with thrust block. Where a joint or coupling in the existing pipe is uncovered at the cut and cap locations, the installation of a plug may be permitted with approval from the

TVMMWC Engineer.

- C. Valve Extension Stems** – Valve extension stems are required where the distance from the top of the valve box to the top of the operation nut exceeds 40 inches. The valve extension stem shall be a minimum of 24 inches long and shall be within 24 inches of the surface.
- D. Air Relief Valves** – In the absence of services to relieve air trapped in high points of the water main, air relief or air vacuum relief valves are required on pipeline high points.

8-15 HYDRANTS AND BLOW-OFFS

- A. Location** – Hydrants and blow-offs shall adhere to the following criteria:
 - 1. Fire hydrants shall be placed at street intersections wherever possible. Hydrants located at intersections shall be installed at the curb return on the same side of the water main connection where practical.
 - 2. Fire hydrants and blow-offs not located at intersections shall be installed on property lines between lots.
 - 3. Not more than five hydrants shall be installed on an 8-inch main between intersecting 12-inch mains. The pipeline connecting the hydrant and the main shall be a minimum of 6 inches, with a gate valve flange connected to the main.
 - 4. A blow-off assembly shall be installed on all permanent and temporary dead-end runs. A 2-inch blow-off shall be used on mains 12 inches and smaller. A 3-inch blow-off shall be used on mains 16 inches and larger. In no case shall the location be such that there is a possibility of back-siphonage into the distribution system.
 - 5. Blow-off assemblies shall be located at low points along transmission mains.
- B. Spacing** – Fire hydrants and blow-offs shall have a maximum spacing of 500 feet measured along the street frontage in residential areas and a maximum spacing of 350 feet in all other areas. Where new water mains are extended along streets where hydrants are not needed for protection of buildings or similar fire problems, fire hydrants shall be provided at spacing not to exceed 1,000 feet to provide for transportation hazards. Refer to Madera Fire Code for the number and distribution of fire hydrants served by private fire service water systems.
- C. Cul-de-sacs and Dead-end Streets** – Hydrants shall be required within a cul-de-sac or dead-end street measuring more than 250 feet as

measured from the curb return of the intersecting street and the end of the bulb or street.

8-16 WATER SERVICES – Water services shall be installed at the time the water main is constructed. Service stubs 2 inches and smaller shall be copper. Service stubs 3 inches and larger shall be fully restrained ductile iron or PVC pipes. Services from mains installed in private roads shall be extended 1.5 feet beyond the curb and gutter. Water services shall also conform to the following requirements:

- A. Location** – Water services for residential subdivisions shall be located 12-18 inches behind curbs per these Construction Standards. The building service shall be located to provide the most direct connection to the main. Every effort shall be made to pair services.
- B. Curb Stamp** – The curb shall be stamped with a “W” at all service locations.
- C. Sizing** – The standard size of a single-family residential service line shall be a minimum 1- inch service or as determined by Madera Fire Department. Schools, commercial, industrial, or a multi-family residential developments shall be provided with a larger service subject to approval by the Madera County Public Works Director.
- D. Spacing** – For service laterals 2 inches in diameter or smaller, service saddles shall be a minimum of 12 inches from the end of the main and 24 inches to any other service saddle or pipe joint.
- E. Service Taps** – The TVMMWC reserves the right to make all water service taps onto existing mains upon application for a service tap and authorization for payment. Work by the TVMMWC shall be performed on a time and materials basis. A note to this effect shall be placed on the plan sheet which shows a detail of the area that requires such tapping. The service tap application shall be made to the TVMMWC a minimum of two weeks in advance of the time the tap is desired. All connection fees must be paid prior to the time of application. All excavation, backfill and the installation of the remainder of the water service shall be performed by the Contractor.
- F. Water Meters** – Water meters shall be installed on all water services. Meters shall be purchased through the TVMMWC and installed by TVMMWC forces upon plan approval and payment of the connection fees.
- G. Backflow Preventers** – Backflow preventers shall be installed on all domestic water services supplying commercial properties and those residential properties served by recycled water. The TVMMWC District Engineer shall approve all backflow preventers.

- 8-17 RESTRAINT** – Joint restraint shall be achieved by means of a mechanical joint restraint device. Full pipe restraint shall be required within bridges, casings, dead end runs, temporary dead end runs, and as determined by the TVMMWC Engineer. Restrained pipe within casings or bridges shall be fully extended or “stretched out” to remove the slack between the joints the entire length of the structure. A note shall be placed on the plans. Thrust blocks shall not be used unless specifically called out on the plan set and approved by the TVMMWC Engineer. In the case of hydrant runs and dead-ends, thrust blocks shall be used in addition to mechanical restraints as a redundant feature. Restraint calculations shall be submitted with the plan review. Restraint calculation parameters are as follows: soil type ML, granular fill, 1.5 to 1 safety factor, trench type 4, and minimum test pressure of 150 psi.
- 8-18 WORK NEAR EXISTING WATER MAINS** – Existing transmission water mains shall be clearly shown on the plans. The plans shall have a caution note on the cover sheet, plan/profile sheets, and grading sheets where the transmission main is shown as existing. The notes shall read as follows:

CAUTION EXISTING (name size) WATER MAIN.

No construction shall be permitted within the water main easement without the presence of the TVMMWC inspector. Prior to start of construction, 48-hour notice shall be given. Heavy equipment and vibratory equipment may cross designated segments of the water main with a minimum of 10 feet of cover or approved equivalent. The TVMMWC shall inspect the condition of the existing main prior to paving. Request for inspection shall be made one week in advance.

A. Water Mains 14 Inches and Larger:

- 1.** The TVMMWC shall inspect the interior of the existing water transmission main prior to paving. If damage to the pipe resulting from construction activities is discovered, the Contractor shall be billed for repairs. A minimum of one-week advance notice is required prior to inspection.
- 2.** The Contractor shall provide the TVMMWC with a construction schedule, and a list of equipment proposed to be used within the water main easement.
- 3.** A plastic mesh fence shall be installed on both sides of the water main a minimum of 10 feet from the centerline prior to the start of construction and/or grading operations.

8-19 WATER IMPROVEMENT PLAN REQUIREMENTS – Plans for the construction of water infrastructure, whether in conjunction with other improvements or for a water project only, shall conform to these standards, the Construction Standards, and meet the following requirements.

- A. Water Study** – A water study or water master plan as determined by the TVMMWC Engineer may be required prior to review of the water design if there is a possibility that adjacent areas might require service through the subject property.
- B. General Requirements** – Plans for the water improvement project shall include a layout sheet, plan and profile of each public water line, and necessary detail drawings. Reference to the Construction Standards shall be made for all standard details.
- C. Layout Sheet** – Improvement plans shall include an overall map which shows the project boundaries, water mains, valves, services, and other important items of the work.
 - 1. A parcel which benefits from and financially participates in a water construction project, but is not included within the project boundaries, shall have a note to this effect placed on the layout map and on the plan and profile sheet if the parcel appears thereon. Parcels which make use of those facilities may be subject to additional fees at the time of connection, if the participation has not been so noted.
- D. Plan and Profile Sheets** – Water lines to be maintained by the Tesoro Viejo Master Mutual Water Company shall be shown on both plan and profile. The following standards, with respect to drafting and the information to be included on the plan and profile sheets, generally apply to project in developed areas.
 - 1. Water lines to be constructed shall be indicated on profile by parallel lines spaced to show the pipe diameter to scale. The length, size, and type of pipe material shall be printed parallel to the horizontal grid lines and approximately halfway between the ground surface and pipe line. The profile shall note all proposed appurtenances. Existing facilities shown on the profile shall be dashed or distinguishable from proposed improvement. Manhole identification on the plan view may be oblique. Stationing shall appear at the lower edge of the profile grid directly under the appurtenance.
 - 2. Proposed water services shall be indicated on the plans per the Construction Standards details.

3. Improvements or lots shown on a plan sheet but served to a line shown on another plan sheet shall have the direction of service shown by a small triangle and letter "W."
 4. Both permanent and working easements shall be shown to scale and dimensioned on the plans.
 5. Proposed water lines shall be adequately dimensioned from street centerline. If the water line is to be located in an easement, sufficient dimensions and bearings from physical features to locate the line in the field shall be shown on the plans.
 6. Existing gas, sewer, storm drains, and all other utility lines above or below ground shall be shown on the plans.
 7. Trees and other objects within 10 feet of the construction centerline shall be dimensioned on the plans relative to the construction centerline. The diameter of tree trunks and interfering heavy tree branches shall be noted. Removal of a tree or object, or other special handling shall be noted. Written documentation of any special arrangements regarding preservation of property shall be provided to the Madera County Public Works Director if no easement document is involved. If an easement is negotiated, all special arrangement shall be included in the easement document. Tree removal must be approved by the TVMMWC.
 8. Culverts shall be shown on both plan and profile when crossed by the construction or when parallel and within 20 feet of the construction line. Type, size, and invert elevation shall be called out.
 9. No trees or permanent structures shall be placed within water easements without the approval of the TVMMWC Engineer.
- E. Detail Drawings** – Details not covered by the Construction Standard Detail sheets shall be shown on the plans.

SECTION 9

SANITARY SEWER DESIGN

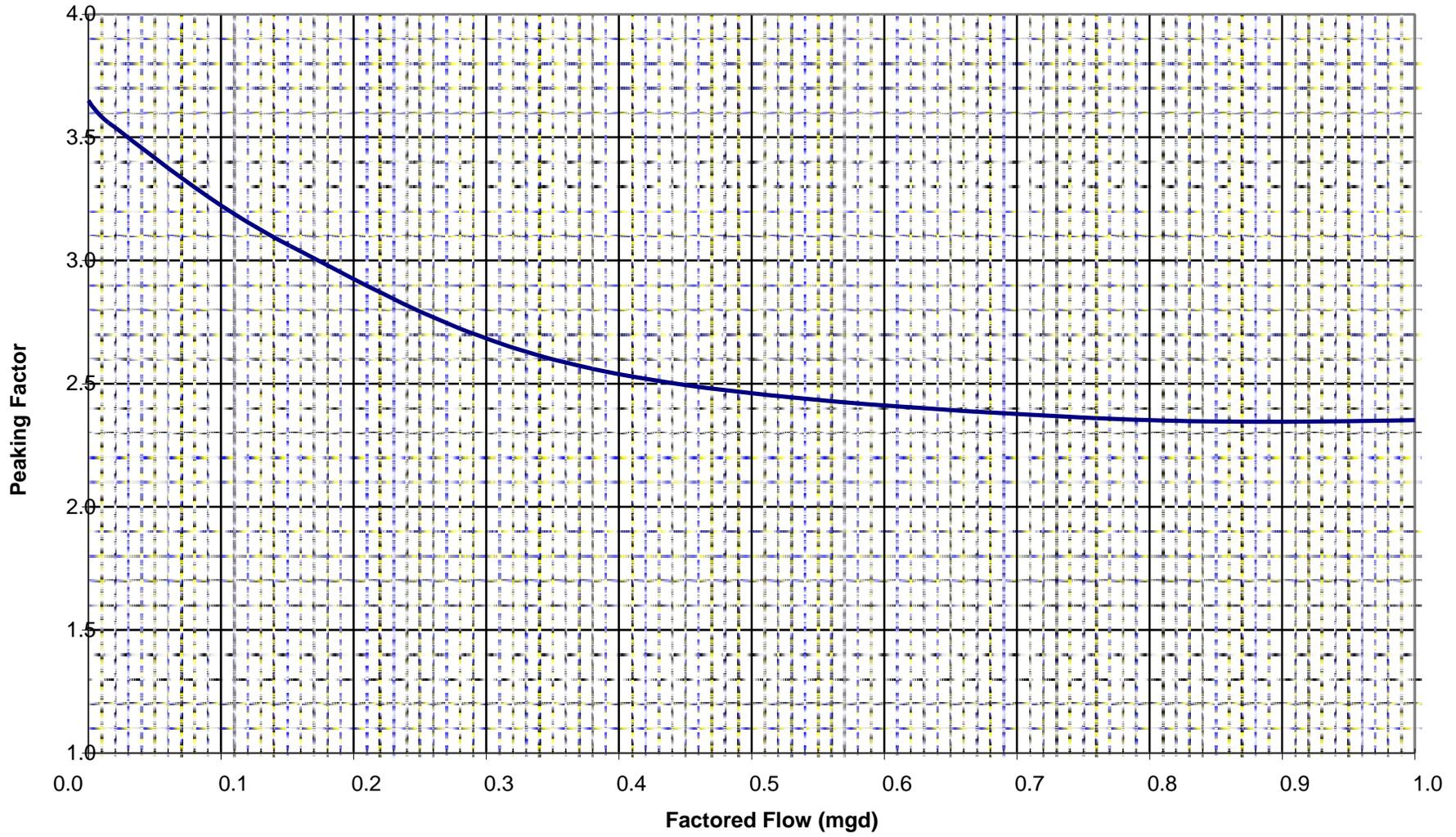
- 9-1 DESIGN CRITERIA** – These criteria shall apply to the engineering design of any sanitary sewer system to be maintained by the Tesoro Viejo Master Mutual Water Company, or with those exceptions as noted, within private multiple ownership residential or multi-parcel commercial and industrial developments.
- 9-2 AVERAGE FLOW DETERMINATION** – The determination of average dry weather flows for design purposes shall be based upon the best available information concerning land use and density as determined by the TVMMWC Engineer. This information may include approved land use and density in accordance with current zoning in the absence of more specific information pertaining to expected development. Average dry weather flow factors are listed in Table 1.

Table 1 – Average Dry Weather Unit Flow Factors

Land Use Designation	Units	Flow Factor (gpd/unit)
Commercial	gpd per acre	1,525
Heavy Industrial	gpd per acre	3,100
Light Industrial	gpd per acre	3,100
Business Professional	gpd per acre	1,525
Public/Quasi-Public	gpd per acre	1,525
Schools-Elementary	gpd per acre	1,150
Schools-High School	gpd per acre	1,150
Residential (VLDR)	gpd per DU	240
Residential (LDR)	gpd per DU	240
Residential (MDR)	gpd per DU	240
Residential (HDR)	gpd per DU	206
Open Space	gpd per acre	0
Parks > 10 Acres	gpd per acre	300
Vacant	gpd per acre	0

- 9-3 DESIGN FLOW**– Design flow sizing of infrastructure 15 inches in diameter and smaller shall be calculated by using the average dry weather unit flow factor(s) listed in Table 1 for the upstream service area along with an allowance of 400 gpd/acre for groundwater infiltration and the appropriate peaking factor listed on Figure SS-1. Attachment A located at the end of this section provides a sample calculation. For sizing trunk sewers 18 inches in diameter and larger, utilize the hydraulic model of the collection and conveyance system and consult with TVMMWC staff.

Figure SS-1
Peaking Factor Curve



9-4 PIPE CAPACITY, SLOPE, VELOCITY, SIZE, DEPTH AND MATERIAL
 – Design criteria for the pipe system are as follows:

A. Main Sizes – The minimum size sewer main within a residential development shall be 6 inches in diameter. The minimum size sewer main for commercial and industrial developments shall be 8 inches in diameter.

B. Slope and Velocity – Manning’s formula shall be used to determine the relation of slope, design flow, velocity, diameter, and “n” value. The “n” value shall not be less than 0.011 for all pipe materials.

1. Table 2 provides minimum slopes and design flow capacities for various pipe diameters. Pipe slopes less than those listed in this table shall not be used without the approval of the TVMMWC Engineer. The slopes indicated are based on a velocity of two feet per second with the pipe flowing full.

Table 2 – Minimum Slopes and Flow Capacities

PIPE DIAMETER (IN)	SLOPE (ft/ft)	CAPACITY AT 0.7 DEPTH	CAPACITY FLOWING FULL
6	0.0035	0.21 MGD	0.25 MGD
8	0.0024	0.38 MGD	0.45 MGD
10	0.0018	0.59 MGD	0.71 MGD
12	0.0014	0.85 MGD	1.02 MGD
15	0.0011	1.37 MGD	1.60 MGD
18	0.0008	1.90 MGD	2.35 MGD
21	0.0007	2.68 MGD	3.20 MGD
24	0.0006	3.54 MGD	4.23 MGD

2. The maximum depth of flow at design conditions in any lateral 10 inches in diameter or less shall be 70 percent of pipe diameter. Lines 12 inches in diameter or larger may be designed to flow full unless direct sewer connections are planned, in which case the 70 percent pipe diameter maximum depth of flow shall govern.

3. All sanitary sewer pipe shall be designed for a minimum scour velocity of 2 feet per second at peak flows. The volume of wastewater within the pipe system as determined above shall be used when designing pipe slopes.
 4. Maximum design velocity shall not exceed 10 feet per second unless approved by the TVMMWC Engineer.
- C. Capacity** – Pipe capacity, in all cases, shall be adequate to carry the Peak Wet Weather Flow (PWWF) from the entire tributary shed area even though said area may not be within the project boundaries.
- D. Hydraulic Grade Line** – The hydraulic grade line shall be determined from the design flows, based upon 100 percent development of the tributary area. Hydraulic grade line calculations must be submitted for the design of all lines 12 inches in diameter or larger.
- E. Depth** – Sewer mains with service lateral shall not exceed a depth of 15 feet unless approved by the TVMMWC Engineer. The system shall be designed to provide a minimum slope for sewer services of $\frac{1}{4}$ inch per foot with a minimum cover of 12 inches at any buildable location within the properties to be served. Proposed building pad elevations shall be a minimum six inches above the lowest upstream manhole rim. Where the building pad does not meet the elevation requirement, a backwater valve for the building shall be required. The backwater valve shall be noted on the improvement plans and building plans. Installation shall be made during construction of the underground improvements. Deed restrictions shall be put in place which hold the TVMMWC harmless for failure of the backwater valves on such lots.

9-5 SEWER LOCATION AND ALIGNMENT REQUIREMENTS –
Location and alignment criteria are as follows:

- A. General** – All sanitary sewers shall be placed in rights-of-way dedicated for public streets or within easements approved by the TVMMWC Engineer. Developments with deep sewer mains or with trunk mains may require dual sewer mains. There shall be a minimum horizontal clearance of 10 feet between parallel water, recycled water, and sanitary sewer mains. A minimum horizontal clearance of 5 feet shall be maintained between sewer mains, parallel storm drains, and other utilities unless approved by the TVMMWC Engineer. On crossings, water and recycled water lines shall be a minimum of 12 inches above the sewer line unless approved by the TVMMWC Engineer. If a sanitary sewer force main must cross a water or recycled water line, refer to sections 8 (Domestic Water Supply System) and 14 (Recycled Water Supply System) of these standards.
- B. Location in New Subdivisions** – In new subdivisions, sewers shall be

located at the street centerlines within minor and primary residential streets, or as approved by the TVMMWC Engineer.

- C. Location in Existing Streets** – When sanitary sewers are to be installed in an existing street, factors such as curbs, gutters, sidewalks, traffic conditions, traffic lane conditions, pavement conditions, future street improvement plans, and existing utilities shall be considered.

The approval of the Madera County Public Works Director and TVMMWC Engineer shall be obtained in every instance.

- D. Location in Unpaved Area** – All mains in unpaved areas shall be marked every 133 feet maximum between manholes with a green 5-foot 6-inch composite utility marker. A decal shall be placed on marker stating “CAUTION SEWER PIPE.” Utility marker shall be Carsonite or approved equal with anchor barb kit.

- E. Easement Sewer Lines** – Easement sewer lines outside of the public right-of-way, or within a narrow right-of-way shall require an easement dedication to the TVMMWC. Sewer lines shall be centered within their easement. Easements shall be completely on one side of the property line of fence. The easement shall be clear of permanent structures, building eaves, roof lines, and the future trunk of large tree species. Temporary construction easements of adequate size shall also be provided. The proposed easement shall be the greater of the following:

1. Minimum width of easement shall be 15 feet.
2. All easements shall have a minimum width equal to the required trench width according to the standard detail for trench backfill, plus 2 additional feet for every 1 foot of depth of the pipe as measured from the bottom of the pipe to finished grade. All sewer lines shall be centered within their easement.

- F. Public Lines in Commercial Developments** – Sewer mains shall be located within drive aisles unless otherwise approved by the TVMMWC Engineer.

- G. Water Well Clearance** – Sewer lines shall maintain a minimum 100-foot separation from all public or private wells. (Properly abandoned wells are not included.) If a clearance of less than 100 feet is approved, the pipe material shall be approved by the TVMMWC Engineer. In no case shall the clearance be less than 50 feet.

- H. Lines in Drainage Swales** – Sewer lines, public or private, shall not be located within a drainage swale unless approved by the TVMMWC Engineer. The horizontal distance between the sewer line and the top of

the bank shall be sufficient to maintain the integrity of the drainage swale and provide access for maintenance to the sewer line.

I. Alignment – Sewer lines and structures shall be designed to provide a minimum 12-inch vertical clearance from all utilities and/or improvements, unless otherwise approved by the TVMMWC Engineer.

1. Horizontal alignment shall be parallel to the street centerline. Minimum radius for sanitary sewers 6 inches through 12 inches in diameter shall be 200 feet. For pipe 27 inches in diameter or larger, mitered joints, fittings, or other methods as specified in the Standard Construction Specifications may be utilized to accomplish alignment changes.
2. Vertical alignment shall provide a constant slope between manholes. If a change in grade is necessary, construction of a manhole shall be required unless the use of a vertical curve, or other means, is approved by the TVMMWC Engineer. In such case, elevations shall be shown at 10-foot intervals throughout the length of the vertical curve. The maximum deflection permitted shall be two percent for each 10-foot interval.

J. Sewer Main Stub – Sewer main stubs for future development which are perpendicular to the sewer main shall be ductile iron pipe or PVC originating from the manhole. The stub shall be within 150 feet of the manhole and terminate 5 feet into the future development. Green carsonite marker shall be installed at the end of the stub.

9-6 TRENCH LOADING CONDITIONS AND PIPE DESIGN – The loading condition and pipe design criteria for conduits are as follows:

A. Rigid Conduit Loading – On rigid conduits, Marston’s formula shall be used to determine the load placed on the pipe by backfill. The procedure for rigid pipe is described in the ASCE Manual and Report of Engineering Practice No. 60, the Clay Pipe Engineering Manual, and in similar handbooks. In the absence of specific soils data, as determined by the soils engineer, a soil weight of 120 p.c.f. and a Ku factor of 0.110 shall be used. Minimum strength requirements for vetrified clay pipe shall be shall be as specified per ASTM C-700 “extra strength” VCP.

B. Safety Factor – On rigid conduits, a safety factor of 1.5 shall be used for all pipe. The three edge bearing strength of the pipe shall be used in the computation for rigid pipe.

C. Bedding and Initial Backfill – Unless otherwise noted on the plans, bedding and initial backfill shall be per the Construction Standards. Special backfill requirements shall be noted on the plans.

D. Special Pipe Strength Requirements – For sewer mains greater than 20 feet deep or mains requiring extra support strength, pipe material shall be approved by the TVMMWC Engineer. Ductile iron pipe shall be used if cover is less than three feet or insufficient clearance exists between the sewer pipe and the rigid load transmitting structures. Such structures include large diameter storm drains and other structures subject to settlement. The ductile iron pipe shall extend 5 feet each side of the structure crossing.

9-7 MANHOLE CRITERIA - The design criteria for manholes are as follows:

A. General – Manholes shall be placed at the intersection of all sanitary sewer lines, at the upstream end of a pipe run, and at the end of any temporary line more than 200 feet in length. No more than three lines may enter a manhole with one line exiting. Medium-density single-family subdivisions may enter a manhole with up to 4 services with one exiting main line upon approval of the TVMMWC Engineer.

B. Spacing – Maximum spacing of manholes shall be 500 feet for all straight lines of 10 inches in diameter or less. Manhole spacing for mains 12 inches and larger shall be considered on a case by case basis. A line with a radius greater than 400 feet shall be considered as straight for purposes of this section. Manhole spacing on curved lines of 200-foot radius (minimum allowable) shall be 200 feet. Manhole spacing on curved lines of radii between 200 and 400 feet, or where only a portion of the line is curved, shall be adjusted proportionately. Reverse curves require a manhole at the point of tangency of the curves or as determined by the TVMMWC Engineer. A manhole shall be required at any change in vertical alignment unless use of a vertical curve is approved by the TVMMWC Engineer.

C. Invert Elevations – The invert elevation for pipe of the same diameter entering a manhole shall have a 0.10-foot drop between the entering and exiting pipe. Under special circumstances, the 0.10-foot drop may be waived with the approval of the TVMMWC Engineer. Invert elevations for pipe of different diameters shall match crown of exiting pipe unless approved by the TVMMWC Engineer. The crown of the entering pipe shall be at the same elevation or higher than the exit pipe. Mains with 10 or fewer services shall enter manholes at an invert to crown match with the exit pipe unless approved by the TVMMWC Engineer. Lateral mains entering trunk mains, as defined by the TVMMWC Engineer, shall enter manholes at an invert to crown match with the exit pipe.

D. Manhole Sizing – A standard 48 inch manhole with a 24 inch access opening shall be used for sewer mains 12 inches and smaller and not exceeding 20 feet depth unless approved by the TVMMWC District

Engineer. A 60 inch manhole with a 36 inch opening shall be used for sewer trunk mains 15 inches to 36 inches in diameter unless approved by the TVMMWC District Engineer. The design of larger trunk mains shall be approved on a case-by-case basis.

E. Manhole Coatings – Manholes shall be required in areas determined to have a potential of generating excessive sulfide gases. Such manholes shall include, but are not limited to, all manholes on trunk mains 15” in diameter or larger, the first manhole originating from a sewer trunk main 15 inches in diameter or larger, force main transition manholes, manholes designed with inside drops, or as determined by the TVMMWC Engineer.

F. Manhole Access – Provisions must be made to prevent vegetation from overgrowing the manholes. An all-weather 10-ton vehicular access shall be provided to each manhole as required by the TVMMWC Engineer. (Turning radii of 30 feet inside and 45 feet outside, and a vertical clearance of 14 feet are required.)

G. Connection to TVMMWC Mains – Improvement plans which require a connection to an existing Tesoro Viejo Master Mutual Water Company sewer main or structure shall specify that such connection be performed by TVMMWC forces on a time and materials basis.

9-8 DROP CONNECTION CRITERIA – Drop connections shall be permitted under special conditions and with the approval of the TVMMWC Engineer. There shall be no more than two inside drop connections into a 4-foot diameter manhole. If an elevation difference of at least 3 feet is not available, the slope of the incoming line shall be increased to eliminate the need for the drop.

9-9 MAINLINE AND DIP TRANSITIONS – Mainline transitions shall be made at a sewer manhole. Transitions for services may be made at a manhole or with the use of a specially fitted DIP-PVC shear band caulder coupling. Arrangements for the special spigot shall be coordinated with the TVMMWC.

9-10 SEWER SERVICE DESIGN – The design criteria for sewer services are as follows:

A. General – Services shall be designed and constructed perpendicular to the main or as approved by the TVMMWC Engineer. The service shall extend from the main to the edge of the public right-of-way or easement. The cleanout shall be constructed per the Construction Standards. Services shall extend fifteen feet beyond edge of pavement of private roads. Easements of adequate width to accommodate the service shall be obtained. (A plan and profile of services shall be supplied to the TVMMWC Engineer on request.)

1. Cleanouts shall be designed and constructed to grade with subdivision improvements or at the time connection is made to the building sewer. Unless otherwise noted on the plans, construction of the cleanout to grade is the responsibility of the contractor for the subdivision improvements. If installation of the cleanout is deferred, the plans shall call for the placement of a 4-inch by 4-inch post at the end of the service sewer extending from the flow line to not less than 12 inches above ground surface or other means approved by the TVMMWC Engineer.

B. Sizing – The minimum size service for single-family developments shall be 4 inches in diameter. Services greater than 100 feet in length shall be 6 inches in diameter. Schools, commercial, industrial and multiple residential properties shall be served by a minimum 6-inch diameter service.

1. **Connection to Sewer Mains** – Residential services shall connect to the sewer main by means of a factory fitting. Properties with services located at the end of cul-de-sacs shall enter a manhole. A 6-inch service shall enter a 6-inch main by means of a manhole. A 6-inch service entering a 8-inch or larger main must either be connected with a manhole or by means of a factory fitting with a manhole placed at the property line. Services 8 inches in diameter and larger shall be connected to the main by use of a manhole. Connection to trunk mains shall be approved by the TVMMWC Engineer. (In no case shall a service connection be made with the use of a wye.)
2. **Connection to Existing Sewer Mains** - The TVMMWC reserves the right to make all sewer service taps onto existing mains upon completing an application for a permit and payment of the required connection fees. Proposed work by the TVMMWC shall be performed by TVMMWC forces and payment made to the TVMMWC for such work will be on a time and materials basis. A note to this effect shall be placed on the plan sheet which shows a detail for the area that requires such tapping. The application shall be made to the TVMMWC. Connection fees shall be paid prior to submittal of the application. All excavation, backfill, and the installation of the remainder of the sewer service or stub shall be performed by the Contractor.
3. **Connection Limitations** – Sewer services shall connect to 12-inch diameter and larger pipe or to lines more than 15-feet in depth at a manhole. Direct connection to trunk mains shall only be with the approval of the TVMMWC Engineer.
4. **Material** – The service shall be of the same material as the lateral to which it connects or as specified by these standards.
5. **Location** - A sewer service shall be constructed to each lot. In new

subdivisions or developed areas, unless specifically requested otherwise in writing, sewer services shall be placed on the low side of a typical subdivision lot or similar parcel with 2 percent or greater slope across the front, or shall be placed in the center of lots of lesser slope. Consideration shall be given to trees, improvements, etc., so as to minimize interference when the service sewer is extended to service the house.

If the property is located such that service is available both to a line located in an easement and also in a right-of-way, service shall be at the latter location unless otherwise approved by the TVMMWC Engineer. No sewer service shall be located such that future on-site construction will result in the line being in such proximity to a water well or water main or service that applicable health standards will be violated.

C. Depth – Adequate depth of sewer service at the edge of easement or right-of-way to service the intended parcel shall be verified. A depth of 3 to 4 feet to crown of pipe, measured from existing ground surface or edge of adjacent roadway, whichever is lower, shall be considered the standard for service sewer depth, except where the water main is to be installed at back of sidewalk as part of the subdivision improvements. In such cases, service shall have a minimum depth of cover of 4-feet 6- inches at the property line and the service shall be extended to a minimum of 7 feet back of sidewalk with the cleanout to grade remaining within 2 feet of back of sidewalk. When greater depth is required, the invert elevation of the service sewer at the edge of the right-of-way or easement shall be noted on the improvement plans. If a joint trench is being utilized for other utilities, the plans shall indicate that a joint trench will exist and service elevations shall be adjusted accordingly. Sewer service connection to the main shall not exceed 15 feet unless approved by the TVMMWC Engineer.

D. Special Requirements in Developed Areas – In developed areas, a sewer service shall be provided to each parcel participating in the project which contains a source of sewage less than 200 feet from a lateral. A property owner's request for service location shall be honored whenever practical. Parcels which have two or more sources of sewage must have an independent sewer service provided for each sewage source which can be separated from the rest of the parcel and sold. A service shall be provided to each lot. During the design period, each property owner affected by the proposed work shall be contacted in writing to determine the preferred sewer service location. In absence of a response, a sewer service shall be provided in accordance with these standards. In addition, upon staking the location of the proposed sewer services prior to construction, each property owner shall be given a final opportunity to approve the proposed sewer service location. Compilation of this information shall be furnished to the TVMMWC Engineer.

- E. Warranty Inspection of Sewer Main Stubs** – As a requirement, sewer stubs are provided to subdivisions as a courtesy by developers during the construction of backbone infrastructure in streets to prevent cutting up the newly paved streets when the subdivisions are ready to develop. These stubs become an integral part of the sewer system of the subdivisions and subsequently the responsibility of the developers of the subdivisions and are therefore subject to both construction and warranty inspections. This practice saves future developers construction time and cost that would have otherwise been spent on tie-ins and street repairs. Contractors will be required to test and repair these stubs, if found damaged, prior to tie-ins. A note to this effect shall be placed on the improvement plans.
- F. Abandoning Existing Sewer Stubs** – Existing sewer stubs to be abandoned shall be abandoned by means approved by the TVMMWC Engineer.
- G. Grease Interceptor** – A grease interceptor shall be required for any business having the potential of producing grease as specified in the Madera County Municipal Code. Minimum size of the interceptor shall be 1000 gallons. Sizing of the interceptor shall be based on the latest California Plumbing Code.
1. General Commercial/Retail buildings shall require dedicated grease lines for future use. A location for the future grease interceptor shall be identified on the improvement plans.
- H. Oil/Sand Interceptor** – An oil/sand interceptor shall be installed for any business having the potential of producing oil and sand waste resulting from routine maintenance as specified in the Madera County Municipal code. Minimum size shall be 450 gallons. Sizing of the interceptor shall be based on the latest California Plumbing Code.
- I. Automatic Car Wash** – An oil/sand interceptor or an approved clarifier shall be installed for an automatic car wash as specified in the Madera County Municipal Code. The car wash shall recycle a minimum of 75% of the water used prior to discharging into the TVMMWC's sewer system. Minimum size of oil/sand interceptor shall be 450 gallons. Sizing of the oil/sand interceptor shall be based on the latest California Plumbing Code
- 9-11 CREEK CROSSING DESIGN** – Advance approval of the TVMMWC Engineer, and other appropriate agencies is necessary to initiate design. The criteria for creek crossings are as follows:
- A. General** – In all cases, the proposed future creek bed elevation shall be used for design purposes. Crossing details of pipe, piers, anchorage,

transition couplings, etc., shall be shown on a detail sheet of the plans. The top of pipe shall have a minimum 3 feet of cover at the shallowest point of the crossing.

B. Construction and Material – For line sizes 10 inches and smaller, ductile iron pipe shall be used under the full creek width plus 10 feet each side. For line sizes 12 inches and larger, pipe used shall be as determined by the TVMMWC Engineer. The ductile iron pipe shall be supported by steel I-beam piles. The steel I-beam pile shall be installed to a yielding depth as recommended by the soils engineer. Each stick of pipe shall be supported by a least one pile or as approved by the TVMMWC Engineer. A steel plate shall be welded on top of the I-beam. A 1/2-inch thick polyethylene plane shall be installed on top of the steel plate for the pipe to rest on. The pipe shall be held by two 2-inch wide galvanized steel straps, with galvanized bolts attached through the steel plate and polyethylene plate. An insulating material shall be used between the pipe and the section of strap coming into contact with the pipe. All exposed surfaces shall be coated with coal tar epoxy. A layer of 4-inch to 8-inch cobbles shall be placed and compacted on the top surface of the trench area for the full width of the creek. A trench plug shall be required at the top of the pipe at the downstream side of the crossing. The plug shall be a minimum of 4 feet in length, and shall extend 24 inches beyond the width and depth of the trench.

C. Design – Calculations shall be submitted which clearly indicate the design of the pipe and supports regarding impact, horizontal and vertical forces, overturning, pier and anchorage reactions, etc. to the TVMMWC Engineer for review.

9-12 BORING AND JACKING REQUIREMENTS – The requirements outlined in the Construction Standards shall be followed.

9-13 PUMP STATION AND FORCE MAIN REQUIREMENTS – Every phase of pump station design, including force main design, shall be closely coordinated under the direction of the TVMMWC Engineer. The pump station and force main shall be designed and submitted concurrently. The plan sheets will show the general layout and control system required for a typical acceptable sewage pump station. The plans shall call out the testing required for acceptance of the pump station.

A. Location – The pump station and facilities shall maintain a minimum 100-foot separation from existing and proposed residential and commercial structures unless approved by the TVMMWC Engineer. Adequate maintenance access shall be provided to the pump station. The access design shall consider requirements for the removal of pump station equipment.

B. Capacity – The pump station shall be designed to accommodate ultimate buildout flows as well as initial flows. Allowances for larger or additional pumping equipment must be made for future requirements. If the design capacity is in excess of anticipated initial flow, the effects of the minimum flow condition must be estimated to prevent excessive retention of sewage in the wet well, to prevent septic conditions, and to determine whether the pumping equipment will operate within the manufacturer’s guidelines. Table 3 provides planning level criteria for sizing and configuration of pump station and force main facilities.

Table 3 – Planning Level Criteria for Pump Stations and Force Mains

Pump Stations	
Capacity	PWWF (hydraulic modeling required for pipes 18 inches and larger)
Storage	24 hours, or 8 hours with an emergency generator
Operation	Lead/lag for duty pump(s), plus 1 standby pump
Maximum Pump Cycles	6 cycles/hour
Force Mains	
Headloss	Hazen-Williams roughness coefficient (C-factor) of 120
Maximum Velocity	7-10 feet per second
Minimum Velocity	3.0 feet per second

C. Wet Well – The wet well design and detention time shall be such that the deposition of solids is minimized and the sewage does not become septic. Provisions for 24 hour storage capacity or 2 hour storage capacity with an emergency generator shall be provided. An interior protective coating shall be required for the prevention of hydrogen sulfide corrosion of the structure.

D. Pumps – Pumping equipment shall consist of centrifugal pumps. Pump suction and discharge size shall be a minimum of 4 inches in diameter. Pump drive units shall be electric. A sufficient number of pumping units shall be installed such that station capacity can be maintained with any one unit out of service. Provisions for telemetry shall be included in the station control system as directed by the TVMMWC Engineer.

E. Station Pumping - Suction, discharge, and header piping within the station shall be sized to adequately handle flows. Piping less than 4 inches in diameter shall not be used for conveying sewage. Valves shall be located to allow proper equipment maintenance and

operation. The design shall provide a bypass configuration back to the wet well.

F. Odor Control – If required, the station shall have equipment and/or space provided for the purpose of introducing odor control chemicals into the wet well, upstream gravity line, and/or force main. Adequate provisions shall be made for the safe handling and storage of chemical containers. The force main shall be designed to maintain a continuous uphill grade, or, as a minimum be level. All force mains shall have provisions for introduction of either air or odor control chemicals.

G. Force Mains – Force mains shall be designed such that velocities normally fall within a range from 3 to 5 feet per second. If initial capacity of the station is considerably less than ultimate, consideration should be given to the prevention of septic conditions due to extensive detention time within the force main. The feasibility of installing dual force mains to accommodate initial and ultimate flows shall be investigated in such situations. Provisions shall be made introducing a “cleaning pig” into all force mains. The design shall also include facilities to eliminate or sufficiently dampen transient forces and/or surging in the event of an immediate station shutdown. Details shall be included in the improvement plans.

A corrosion protection study shall be included with the improvement plan submittals. Corrosion protection facilities for the force main shall be identified from the roadway with a curb stamp labeled “CP – FM”.

H. S.C.A.D.A. – SCADA requirements for pump stations shall be provided by the TVMMWC. The submittal shall be included along with the improvement plans for such facilities.

9-14 SEWER IMPROVEMENT PLAN REQUIREMENTS – Plans for the construction of sanitary sewers, whether in conjunction with other improvements or for a sewer project only, shall conform to these standards, the Construction Standards, and meet the following requirements unless approved by the TVMMWC Engineer.

A. Sewer Study – A sewer study or sewer master plan as determined by the TVMMWC Engineer may be required prior to review of the sewer design if there is a possibility that upstream or adjacent areas might require service through the subject property. The map shall show the entire area including upstream tributary and adjacent areas, and all other data necessary to determine anticipated sewage flows. The method of providing service to the entire service area, including pipe sizes and slopes, shall be shown to the extent necessary to determine the requirements within the subject

property.

B. General Requirements – Plans for sewer improvement projects shall include a layout sheet, plan and profile of each public sewer line, and necessary detail drawings. Reference to the Construction Standards shall be made for all standard details.

C. Layout Sheet – Improvement plans shall include an overall map which shows the project boundaries, sewer lines, manholes, backwater valves, and other important items of the work.

1. A parcel which benefits from and financially participates in a sewer construction project, but is not included within the project boundaries, shall have a note to this effect placed on the layout map and on the plan and profile sheet if the parcel appears thereon. Parcels which make use of those facilities may be subject to additional fees at the time of connection, if the participation has not been so noted.

D. Plan and Profile Sheets – Sewer lines to be owned and maintained by the Tesoro Viejo Master Mutual Water Company shall be shown on both plan and profile using standard industry practices. The following standards, with respect to drafting and the information to be included on the plan and profile sheets, generally apply to projects in developed areas.

1. Sewer lines to be constructed shall be indicated on profile by parallel lines spaced to show the pipe diameter to scale. Manholes shall also be indicated by parallel lines spaced according to scale. Slope shall be printed 1/8-inch above, and preferably parallel to, the pipe line, or between the parallel lines. The length, size and type of pipe material between each manhole shall be printed parallel to the horizontal grid lines and near the pipe line. Pipe inverts, "IN and OUT," at manholes and other structures shall be indicated on the profile. The invert elevations shall be printed parallel to the horizontal grid lines and shall be underscored by a line which then runs at a 45-degree angle to the corresponding pipe invert. Rim elevation for all manholes shall be labeled. The profile shall note all proposed manholes, special connections, and other appurtenances. Existing facilities shown on the profile shall be dashed or distinguishable from proposed improvements. Manhole identification on the plan view may be oblique. Stationing shall appear at the lower edge of the profile grid directly under the manhole.
2. Proposed sewer services shall be indicated on the plans by stationing, or an approved reference point such as a property line. The invert elevation of the service at its upstream end may be shown on the plans whenever the standard depth is inadequate to serve the property.

Standard depth shall conform to the conditions set forth in the Construction Standards.

3. Improvements or lots shown on a plan sheet but served to a line shown on another plan sheet shall have the direction of service shown by a small triangle and letter "S." "As Built" plans shall also show the service sewer location measured from the nearest downstream manhole.
 4. Both permanent and working easements shall be shown to scale and dimensioned on the plans.
 5. Proposed sewer lines shall be adequately dimensioned from street centerline. If the sewer is to be located in an easement, sufficient dimensions and bearings from physical features to locate the line in the field shall be shown on the plans.
 6. Existing gas, water, storm drains, and all other utility lines above or below ground shall be shown on the plans.
 7. Trees and other objects within 10 feet of the construction centerline shall be dimensioned on the plans relative to the construction centerline. The diameter of tree trunks and interfering heavy tree branches shall be noted. Removal of a tree or object, or other special handling shall be noted. Written documentation of any special arrangements regarding preservation of property shall be provided to the TVMMWC Engineer if no easement document is involved. If an easement is negotiated, all special arrangements shall be included in the easement document. Tree removal must be approved by the Planning Department.
 8. Culverts shall be shown on both plan and profile when crossed by the construction or when parallel and within 20 feet of the construction line. Type, size, and invert elevations shall be called out.
 9. No trees or permanent structures shall be placed within sewer easements without the approval of the TVMMWC Engineer.
- E. Detail Drawings** – Details not covered by the Construction Standard Detail sheets shall be shown on the plans.

F. Connection To Existing Facilities Where Bypassing Or Stoppage of Existing Flow Will Be Required – Upon approval of the application to connect to an existing sewer main by the TVMMWC Engineer, a coordination meeting to discuss the work plan shall be organized by the contractor a minimum of seven calendar days prior to the proposed connection or as permitted by the TVMMWC's work schedule. Should the

TVMMWC Engineer determine that such work be performed by TVMMWC forces, the work shall be performed on a time and material basis.

- 9-15 MULTI-PARCEL COMMERCIAL AND INDUSTRIAL DEVELOPMENTS** – “On-site” sewer mains for new commercial and industrial developments containing more than one parcel, shall be designed in accordance with the requirements contained in these standards or as approved by the TVMMWC Engineer. The sewer main shall be installed within a dedicated public sewer easement in accordance with these standards. Each separate parcel within a multi- parcel commercial or industrial development shall have a separate connection to the public sewer line(s).

ATTACHMENT A: Example Design Flow Analysis for Sewers 15 Inches and Smaller

Example calculation for application of safety factor and peaking factor curve a for 400-unit single family subdivision on 100 acres:

ADWF^a:

$$(400 \text{ DUs}) * (240 \text{ gpd/DU}) = \mathbf{96,000 \text{ gpd} = ADWF}$$

PDWF:

$$ADWF * (\text{Peaking Factor}^b) = 96,000 * 3.24 = 311,040 \text{ gpd} = PDWF$$

I&I:

$$(\text{Area}) * (400 \text{ gpd/acre}) = (100 \text{ acres}) * (400 \text{ gpd/acre}) = \mathbf{40,000 \text{ gpd} = I\&I}$$

PWWF:

$$PDWF + I\&I = 311,040 \text{ gpd} + 40,000 \text{ gpd} = \mathbf{351,040 \text{ gpd} = PWWF}$$

sewer for this flow based on Section 9-4.

For example, per Tesoro Viejo Master Mutual Water Company Improvement Standards, Section 9-4, a 10-inch sewer line at minimum slope is adequate for this PWWF.

^a Based on ADWF unit flow factors shown in Table 1

^b From Figure SS-1

SECTION 10

DRAINAGE

10-1 GENERAL – This Section is formulated to clearly define acceptable drainage analysis and design criteria for development in the TVMMWC. Drainage facets not covered in this Section shall conform to the Madera County Flood Control and Water Conservation District “Stormwater Management Manual” (SWMM), latest edition, and good engineering practice.

10-2 TVMMWC POLICIES AND REQUIREMENTS – All residential lots shall have minimum pad elevations of one foot above the 100 year water surface elevation and all commercial sites shall have minimum finished floor elevations of one foot above the 100 year surface elevation assuming failure of the drainage system. This requires the Consulting Engineer to provide an overland release for all projects or provide storage for the 100 year storm frequency.

The overland release path shall be constructed in a manner to transport the peak rate runoff from the 100-year storm frequency through the site assuming all storm drains are inoperative, all upstream areas are fully developed, and that antecedent rainfall has saturated the tributary watershed. Streets, parking lots, playgrounds, pedestrian areas, pedestrian walkways, utility easements, and other open space areas may be considered compatible uses within the overland release path.

Except for single family or duplex residential lots, site drainage shall be collected on-site and conveyed via an underground storm drain system to approved existing storm drainage system without flowing into existing street gutters or existing roadside ditches unless approved by the TVMMWC.

Unless regional storm water mitigation devices are available specific mitigation shall be required for the project, shall be located on-site, and shall be maintained by the landowner.

10-3 DEVELOPMENT IN OR ADJACENT TO A REGULATORY FLOODPLAIN – Residential lots developed in or adjacent to the TVMMWC’s Regulatory Floodplain shall have pad elevations a minimum of two feet above the TVMMWC’s 100-year flood elevation. A Letter Of Map Amendment (LOMA) or a Letter Of Map Revision (LOMR) is required for any residential lot in or adjacent to the flood hazard area as shown on a Flood Insurance Rate Map. Non-residential projects shall have finished floor elevations a minimum of two feet the TVMMWC’s 100-year flood elevation. Elevations Certificates are required for such non-residential structures. In areas where the 100-year flood depths are less than eight feet, the above freeboard requirements will be increased to a minimum of three feet.

In the case of no-grade or contour grade lots, located adjacent to the TVMMWC’s

Regulatory Floodplain, and where a portion of the lot may become inundated with the 100-year storm event, a standard Guarantee letter shall be submitting to the TVMMWC prior to plan approval, or issuance of a building permit. The Guarantee letter shall be submitted by a Registered Civil Engineer or Land Surveyor licensed in the State of California and confirm that the lowest ground elevation adjacent to the building foundation meets the minimum requirements for pad elevations as described above.

If a tentative project is submitted which shows fill or other significant improvements within the Regulatory Floodplain, a hydraulic study shall be required to determine the effect of the encroachment. Encroachment shall not result in any off-site increase in water surface elevation. The Consulting Engineer should contact the TVMMWC to ascertain what existing studies, if available, should be used as a base model for the proposed development. The Consulting Engineer is responsible for assembling the necessary data and presenting the study to the TVMMWC for review. The study should reflect ultimate build-out conditions of the watershed. When submitting plans that show improvements in the floodplain, the Consulting Engineer must submit a "Compliance Statement", stating that the proposed improvements shown on the plans are accurately reflected in the approved hydraulic study. A sample of the "Compliance Statement", the hydraulic study submittal requirements, and sample Hydraulic Study Worksheets are provided in the attachments at the end of this section.

Parking lots and storage areas shall be no more than 1.5 feet below the 100-year water surface elevation.

When developing property inundated by the TVMMWC's Regulatory Floodplain, the portion of property that extends into the floodplain shall be dedicated to the TVMMWC in fee or as a Flood Water Conservation Easement as determined by the TVMMWC. In areas where the floodplain has been dedicated as part of a Specific Plan but the 100-year flood levels are shown to extend slightly outside this dedicated floodplain area, the development shall fill the property located outside the dedicated floodplain to an elevation that is a minimum of two feet higher than the 100-year flood elevation, or incorporate that area into the floodplain.

All development in the TVMMWC's Regulatory Floodplain shall comply with the regulations of the TVMMWC's General Plan.

NOTE: Design requirements for bike paths within the floodplains are provided in the section entitled "Bikeways" of these Design Standards.

10-4 FEDERAL FLOOD PROGRAM – Amendments of the FEMA flood maps will be required of all new developments located in a FEMA flood zone. Petitions for Letter of Map Amendment, including any fee required by FEMA, shall be submitted to the TVMMWC and the County of Madera prior to approval of the improvement or site plans.

10-5 DRAINAGE DIVERSIONS – The diversion of natural drainage is allowable only within the limits of the proposed improvement. All drainage must enter and leave the improved area at its original horizontal and vertical alignment unless an agreement, approved by the TVMMWC, has been executed with the affected property owners. Temporary drainage diversions during construction shall be approved by the TVMMWC Engineer and shall be located and constructed in such a fashion as to permit their removal when necessary for the prevention of damage to adjoining properties.

10-6 DRAINAGE EASEMENTS – Publicly owned drainage conduits and channels will not be allowed on private property unless they lie within a dedicated public drainage easement. Where minor improvement of an existing channel falls on adjacent property (such as day lighting a ditch profile) a notarized right-of-entry from the property owner(s) for such construction shall be required. A copy of the document, which grants such approval, shall be submitted to the TVMMWC Engineer prior to the approval of the improvement plans.

A. Easements for closed conduits shall meet the following width criteria:

1 All easements for closed conduits shall have a minimum width in feet equal to the required trench width according to the standard detail for unshored trenches and excavation backfill plus two (2') additional feet of width for every foot of depth as measured from the bottom of the pipe to finish grade. All conduits shall be centered within their easements.

2 Minimum width if any easement for closed conduit shall be 15 feet.

3 Easements adjacent to property lines shall be located entirely on one parcel.

B. Drainage easements for open channels shall have significant width to accommodate the following criteria:

1 Contain the channel and channel slopes.

2 Provide for fencing, where required.

3 A 15-foot wide service road and maintenance access ramps. A service road may not be required where the channel bottom is lined and a suitable access ramp is provided. Dedication of easements shall be completed and submitted to the City Engineer with copies of deeds or title reports for the affected properties before improvement plans will be approved.

C. Open channels (natural or man-made) with a drainage area that exceeds 300 acres shall have the 100-year water surface elevation limits dedicated to the TVMMWC in-fee or as Flood Water Conservation Easement.

10-7 DRAINAGE CAPACITY/DESIGN -All drainage systems shall be designed to accommodate the ultimate development of the entire upstream watershed. The 10-year peak storm discharge shall be used in the design of local drainage

systems. In addition, other facilities such as streets, bridges, open channels, and buildings have requirements that relate to the 2 and 100-year peak storm discharge. The Consulting Engineer shall calculate the 2, 10, & 100-year peak discharge and submit these calculations along with the plans for all proposed drainage systems.

10-8 DESIGN PEAK DISCHARGE METHODS – The design peak flowrate shall be determined from the procedures found in either Chapter 4 or 5 of the USDA’s Urban Hydrology for Small Watersheds TR-55. The procedures in Chapter 4 of TR-55 are simpler and provide, in most cases, adequate results. Thus, it is expected that most Design Engineers will utilize the procedures found in Chapter 4 of TR-55. Use a Type I SCS 24-hour rainfall distribution for the Tesoro Viejo project area. The following information shall be utilized to bring the procedures found in TR-55 into conformance with TVMMWC Design Policies:

A. Drainage Area (A_m)

Every catch basin has one or more Drainage Areas that contribute surface runoff. The size of a Drainage Area shall include the total contributing lot area plus the total contributing road frontage area. It is necessary to compute the flowrate contributed from each drainage area in order to be able to check curb and gutter for conformance with maximum capacity constraints.

B. Time of Concentration (T_c)

Every Drainage Area (A_m) has an individual Time of Concentration. The Time of Concentration shall be determined from the following formula:

$$(T_c) = \text{Lot Flow Time} + \text{Gutter and/or Ditch Flow Time}$$

1. Lot Flow Time:

The Lot Flow Time utilized in determining the total time of concentration shall be found in the following table. The Design Engineer should extrapolate or interpolate to the desired lot depth. These values have been calculated assuming the methods presented in Chapter 3 of TR-55.

Lot Depth	Lot Flow Time
75 feet and less	0.20 hrs.
100 feet	0.27 hrs
200 feet	0.58 hrs
300 feet	0.85 hrs

2. Gutter or Ditch Flow Time:

Gutter or Ditch Flow Times may be estimated using the velocities given in Tesoro Viejo Drainage Study.

C. Drainage Calculation Chart

The Department of Public Works prefers that the Design Engineer utilize the Storm Drainage Calculation Chart provided for peak flowrate calculations as opposed to using Worksheet 4 of TR-55.

10-9 HYDRAULIC STANDARDS FOR DRAINAGE SYSTEMS – All storm drain pipelines and open channels shall be designed to convey the design peak runoff calculated per Section 10-8 and shall conform to the following requirements:

A. Hydraulic Grade Line – The grade line for the 10-year discharge shall be a minimum of one foot below all inlet grates, manhole covers, and all other drainage structures in the system.

B. Manning's Formula – The “n” value used in Manning's formula shall conform to the following:

- 1 Manning's formula shall be used to compute capacities of all open and closed conduits other than culverts.
- 2 A minimum “n” value of 0.011 shall be used for sizing conduits.
- 3 Minimum velocity in closed conduits shall be 2 feet per second. Maximum velocity shall be 12 feet per second unless approved by the TVMMWC Engineer. Velocities shall be based on full flow conditions.

10-10 STREET INUNDATION REQUIREMENTS – Tesoro Viejo streets are allowed to convey runoff for storm events larger than the 10-year. The standards for street inundation are specified in Table 10-1. The Consulting Engineer shall provide calculations showing that these standards are met.

ALLOWABLE STREET INUNDATION: Table 10-1

STREET	2-YEAR STORM	10-YEAR STORM	100-YEAR STORM
<p>LOCAL At continuous grade, uphill, and downhill At Sag Points</p>	<p>Storm water elevation does not exceed top back of curb. Maximum depth in traveled way is 6". Centerline shall be dry</p>	<p>Maximum depth at gutter flow line shall not exceed top-back-of-S/W (if no S/W, or S/W is offset) or a max. of 6". Centerline of street shall remain dry.</p> <p>Storm water elevation does not exceed 4" above the top back of curb. Maximum depth in traveled way – 6".</p>	<p>Maximum depth at gutter flow line shall not exceed 12" above the top –back-of-curb or a max. of 18". Max. depth at centerline is 12"</p> <p>Storm water is a minimum of one foot below building finish floor.</p>
<p>COLLECTOR At continuous grade, uphill and downhill At Sag Points</p>	<p>Storm water elevation does not exceed top back of curb or sidewalk. Maximum depth in traveled way – 6". Centerline shall be dry.</p>	<p>Maximum depth at gutter flow line shall not exceed top-back-of-curb or max. of 6"</p> <p>Storm water elevation does not exceed 4" above the top back of curb. Maximum depth in traveled way – 6".</p>	<p>Storm water flow is contained within the right-of-way. The center 12 feet of roadway shall remain clear of storm water.</p> <p>Storm water flow is contained within the right-of-way. The center 12' of roadway shall remain clear of storm water.</p>
<p>ARTERIAL & EXPRESSWAY</p> <p>At continuous grade, uphill and downhill, or at sag points</p>			<p>All travel lanes are clear of storm water flow. Bike lanes are allowed to be inundated. Storm flow contained within the right-of-way.</p>

10-11 CLOSED CONDUITS – The specific type of pipe or alternate pipe to be used in any development shall be shown on the approved plans. If the Consulting Engineer proposes to use any type of pipe not shown on the approved plans, the plans shall be resubmitted to the TVMMWC Engineer for approval.

A. Size and Material – Drainage systems to be maintained by the TVMMWC shall have a minimum pipe diameter of 12 inches. Private, onsite drainage systems that are reviewed by the TVMMWC shall have a minimum pipe diameter of 8 inches. The types of pipe materials that are allowed are stated in the TVMMWC Construction Standards, Section 63-7 D.

B. Cover Requirements – See Detail TB-2 of the TVMMWC's Construction Standards, latest edition, for pipe cover requirements.

In fill areas, or in areas with poor soil conditions where it is anticipated that a good, firm, vertical-walled trench cannot be constructed, the Consulting Engineer shall design the pipe structural requirements in accordance with good engineering practice. If trench conditions are uncertain, a note shall be placed on the plans making it the Contractor's responsibility to work with the Consulting Engineer to determine and place the proper strength pipe if poor trench conditions are encountered.

C. Alignment – Pipelines for storm drainage shall have a constant slope between manholes, junction boxes, and/or catch basins unless otherwise approved by the TVMMWC Engineer. Minimum radius of horizontal curvature shall be 200 feet. In no case shall the radius of curvature be less than the manufacturer's recommendations for the particular pipe size under consideration.

Drainage pipelines shall be located in the street whenever possible. The location of storm drainage pipelines in the streets shall be a minimum of 5 feet north or west of and parallel with the street centerline unless approved by the TVMMWC Engineer. A minimum angle of 90 degrees shall be accommodated for downstream flow around bends, tees, and connection points.

When storm drainage lines are to be placed in existing streets, factors such as curbs, gutters, sidewalks, traffic conditions, pavement conditions, future street improvement plans, and existing utilities shall be considered.

Open ditches, lined channels, swales, and floodplain areas shall be maintained as nearly as possible in their existing alignment. When an open ditch is to be constructed parallel to an existing roadway, the ditch shall be constructed outside the proposed right-of-way of the ultimate street development.

10-12 MANHOLES – Standard precast concrete manholes shall be constructed as required. Where special manholes or junction boxes are required, the TVMMWC Engineer must accept the design. In no case will junction boxes or manholes be allowed which are smaller than 48 inches inside diameter. Manholes shall be located at junction points, angle points, changes in gradient, changes in conduit size, end of curves and beginning of curves unless otherwise approved by the TVMMWC Engineer. Manholes or junction boxes will not be required for reach of pipe less than 80 feet in length that is to be connected to a 36 inch or larger diameter pipe, subject to approval of the TVMMWC Engineer. For straight alignment, the spacing of manholes shall not exceed 500 feet. The spacing of manholes shall be nearly equal whenever possible. On curved pipe, spacing of manholes shall be as specified in Table 10-2:

MANHOLE SPACING: Table 10-2

RADIUS	PIPE DIAMETER	SPACING
400' OR LESS	ALL	300'
GREATER THAN 400'	24" OR LESS	400'
GREATER THAN 400'	GREATER THAN 24"	500'

A. Saddle Manholes – Saddle manholes may be constructed on storm drain conduit 36 inches or greater in diameter provided that no junction exists with any other storm drain conduit as determined by the TVMMWC Engineer.

B. Covers – All manholes and junction boxes, other than inlets, shall have standard manhole covers per the Standard Drawings. No pipe will be allowed to enter a manhole into the transition portion of the manhole cone unless otherwise approved by the TVMMWC Engineer. Manholes will not be allowed in gutter flow line except where approved by the TVMMWC Engineer. Slotted manhole covers may be used to pick up minor drainage in non-traffic areas.

10-13 INLETS – Drop inlets in streets shall be located on property lines in residential subdivisions except at intersections, where they shall be placed at curb returns unless approved by the TVMMWC Engineer. The depth of flow in the gutter at the inlet shall not exceed 6.0 inches in a 10-year storm and shall not encroach into the traveled ways as specified in Table 10-1 for other design storms.

All inlets located with the right-of-way or easements shall conform to the TVMMWC's Construction Standards. Inlets may be modified for use without curb sections for on-site drainage. Where an inlet is proposed in public streets and sidewalk is not constructed adjacent to the back of curb, a concrete collar shall be placed behind the inlet.

Drop inlets draining public streets may be connected directly to a trunk line 36 inches in diameter or larger by means of a lateral not exceeding 15 inches in diameter and 80 feet in length.

10-14 JUNCTION BOXES – The requirement for junction boxes are as follows:

- A. Junction boxes shall be constructed of reinforced concrete or fabricated from reinforced concrete pipe section where size limitations permit. Structural calculations shall be provided for all junction boxes.
- B. Minimum wall thickness for reinforced concrete junction boxes shall be 6 inches.
- C. The inside dimension of junction boxes shall be such as to provide a minimum of three inches of clearance on the outside diameter of the largest pipe in each face. All junction boxes shall be rectangular in shape unless otherwise approved by the TVMMWC Engineer. Junction boxes deeper than 4 feet shall have a minimum inside dimension of 48 inches.

10-15 INLET AND OUTLET STRUCTURES – The requirements for these facilities are as follows:

- A. **Headwalls, Wingwalls, and Endwalls** – All headwalls, wingwalls, endwalls, preformed end sections, guard rails and bank protection shall be considered individually and shall be, in general, designed in accordance with the Standard Specifications and Standard Plans of the California Department of Transportation and the TVMMWC, Construction Standards.

Guardrails or fencing may be required by the TVMMWC Engineer at culverts, headwalls, box culverts, and steep side slopes.

- B. **Trash Racks and Access Control Racks** – Trash racks will be provided where they are necessary to prevent clogging of culverts, storm drains, and to eliminate hazards. Access Control Racks shall be required on all pipes, 24 inches or larger in diameter unless approved by the TVMMWC Engineer.

10-16 DRAINAGE PUMPS – Drainage pumps shall be avoided whenever possible, and used only with specific approval of the TVMMWC Engineer. If the use of drainage pumps is permitted, the drainage system shall be designed so as to provide for gravity outfall during the summer months and other periods of low water stages. If a low stage gravity outfall is impossible or impractical, an alternative pump of a smaller capacity for low stage flow may be used provided the TVMMWC Engineer grants specific approval.

- A. **Design Requirements** – Pumping installations shall be designed to accommodate a design storm as specified by the TVMMWC Engineer. When a station contains a gravity discharge, pumping capacity must be equal to the design inflow. When the station does not have a gravity discharge, pumping units must be designed to furnish 100 percent capacity with any one pump out. Any deviation from this criteria must receive the specific approval of the TVMMWC Engineer.

Pumping stations shall be designed so that gravity flow does not pass through the pump pit. No motor overload condition shall exist at any sump or flow condition. This does not preclude high sump design if low sump condition does not create an overload.

Each pumping station shall receive separate approval for the electrical system, piping system, housing installation and other miscellaneous design features. The electrical system for drainage pumps shall conform to the electrical code and the State Department of Transportation Standards.

A detailed Operation and Maintenance Plan (O&M Plan) shall be submitted to the TVMMWC Engineer for approval prior to the approval of the pumping station.

B. Maintenance Requirements – Adequate access shall be provided for cleaning the pump sump. Trash racks shall be provided upstream from the pumping plant. Provisions shall be made for easy cleaning of the trash racks. Hatch covers, where used, shall be of raised pattern aluminum floor plate, or other approved lightweight cover. Dissimilar metals shall be insulated from each other when necessary. Ladder rungs, where used, shall be of non-slip variety. All drainage pumping plant sites shall be fenced with an approved TVMMWC fence and access gate system.

10-17 CHANNELS AND OUTFALL DESIGN – Drainage shall be conveyed in an open channel if the drainage area exceeds 300 acres. Residential lots adjacent to open channels shall have minimum pad elevations of two feet above the 100-year water surface elevation. Non-residential lots shall have the lowest ground elevation adjacent to the building foundation at least two feet above the 100-year water surface elevation.

A. Open Channel Design Requirements – Channels shall be constructed to a typical cross section. Fully lined channels shall be designed with side slopes of 1:1 or flatter. Channels with unlined sides shall be designed with side slopes of 3:1 or flatter, or as specified by the Geotechnical Engineer based on existing soil conditions. Lined channels shall have a minimum bottom width of 6 feet. Lined channels shall be finished concrete, sacked concrete, or doweled and sacked concrete. The minimum weight of sacked concrete shall be 60 pounds per bag.

All open channels shall be designed to carry the 100-year frequency design storm. The hydraulic grade line of the 10 and 100-year storms shall be calculated. Freeboard shall be a minimum of one foot for the 100-year event and two feet when the drainage area exceeds 300 acres. The velocity range shall be 2.5 to 6.0 feet per second in unlined open channels and 3.0 to 12.0 feet per second in lined open channels unless otherwise approved by the TVMMWC Engineer. All computations shall be clearly documented and submitted to the TVMMWC Engineer for approval.

For all channels, either realigned or natural, the following shall be shown on

the improvement plans in addition to the information heretofore required:

- 1 The profile of existing channels shall be shown for a minimum of 1000 feet at each end of the development on the construction plan to establish a minimum profile grade.
- 2 Typical sections and cross sections.

B. Interceptor Ditches – Interceptor ditches or approved alternates shall be placed at the top of the cut or bank where deemed necessary by the TVMMWC Engineer to prevent erosion of the channel bank. Runoff shall not be allowed to sheet flow over the top of banks.

C. Outfall Profiles – All drainage outfalls shall be shown both in the plan and profile view, on the improvement plans for a distance of 1000 feet or until a definite “daylight” condition is established. All drainage ditches upstream of the improvement shall be shown on the plan and profile sheets for a distance of at least 500 feet or until an average profile grade through the improvement is established. The profiles shall include ditch flow line and top of bank elevations.

When improvements have more than one unit, the drainage outfall shall be shown as extending to the property boundary and beyond if required, although it may not be constructed with the current unit development. All temporary outfalls shall be shown both in plan and profile view, on the improvement plans.

D. Fencing – Channels exceeding three (3) feet in depth and with side slopes steeper than 3:1 shall be fenced with an approved TVMMWC fence. In all other areas, fencing shall be placed as specified the TVMMWC Engineer. Fences shall be located 6 inches inside the drainage easement lines and a minimum of 12 inches from the top bank. No fencing shall be allowed within the floodway of an open watercourse without the approval of the TVMMWC Engineer. Special requirements shall be specified by the TVMMWC Engineer for fencing within the 100-year floodplain of any open watercourse.

Drive gates shall be provided with a minimum width of 12 feet. A minimum 4-foot wide walk gate shall also be provided unless otherwise approved by the TVMMWC Engineer.

E. Access Roads – An all-weather access road consisting of six (6) inches of compacted AB shall be provided adjacent to all channels and outfall ditches to the satisfaction of the TVMMWC Engineer. Access roads shall have a minimum width of 12 feet and shall provide a bulb at end for turning movements.

10-18 CROSS CULVERTS AND BRIDGES – This section specifies criteria for relatively short circular or box culverts and bridges for transverse crossings (typically road embankments). Cross culverts shall be of the same material as

allowed for closed conduits. (See Section 10-11).

Cross culvert profiles will be determined on an examination of the channel for a minimum distance of 1000 feet on each side of the installation.

Driveway culverts shall be approved by the TVMMWC for size, grade, alignment and type. Driveway culverts will not be allowed unless the TVMMWC has agreed to defer the construction of the curb and gutter unless it is for the temporary construction access.

New culverts or bridges for roadways that cross the TVMMWC's Regulatory Floodplain shall incorporate provisions for the installation of permanent stream measuring equipment. This shall be a 10' x 10' flat pad near the 100-year water surface elevation with vehicle access. A two (2) inch diameter electrical conduit from the pad to the flow line of the channel will be installed.

A. Design Storm – Cross culvert size shall be determined on the basis of runoff as specified in the hydrology portion of this section. Cross culverts, in general, shall be designed for a 10-year storm event with no head on the inlets. They shall also be sized such that no serious damage will be incurred due to ponding as a result of a 100-year event.

A flood easement shall be provided for all areas impacted due to upstream ponding in the 100-year event. Culverts across arterials shall be sized for the 100 year storm with a minimum of one foot of freeboard below the lowest travel lane. Minimum diameter of cross culverts shall be 18 inches.

To account for debris collection, a clogging factor of 150% shall be applied to all storm frequencies in the design of bridges or culverts that cross a channel or stream with a drainage area that exceeds 300 acres.

B. Computation of Flow – Inlet or outlet conditions control flow in transverse culverts. In culverts operating under inlet control, the cross-section area of the culvert barrel, the inlet geometry and the amount of headwater at the entrance are primary importance. Outlet control involves the additional consideration of the elevation of the tailwater in the outlet channel and the slope, roughness and length of the culvert barrel.

Anticipated downstream flow depth and allowable headwater depth govern the available head on culverts. The type of flow under which a culvert will operate may be determined from a given set of conditions. This may be avoided by computing headwater depths from the charts in this section for both inlet and outlet control and then using the higher value to indicate the type of control and to determine the headwater depth. This method of determining the type of control is accurate except for a few cases where the headwater depth is approximately the same for the both types of control. The monographs provided in this section shall be used for culvert design with uniform barrels. Where barrel sizes or entrance configurations differ between barrels, written calculations shall be provided to the satisfaction of the

TVMMWC Engineer.

10-19 DETENTION AND RETENTION BASINS – If detention or retention basins are required for peak flow reduction, the design of the basin must conform to the latest addition of the Tesoro Viejo Drainage Study (Drainage Study). The basin layout and design shall minimize its maintenance time and cost.

10-20 ACCESS FOR MAINTENANCE – These facilities may include, but are not limited to bridges, culverts, headwalls, lined and unlined channels/ditches, sand/oil separators, manholes, retention basins and drain inlets. The access way shall be a minimum 12 feet wide and include six (6) inches of $\frac{3}{4}$ inch aggregate base (95% relative compaction) over six (6) inches of processed, native soil (95% RC). Upon the TVMMWC Engineer's request, four (4) inches of asphalt concrete shall be added to the section and/or a cul-de-sac with a minimum diameter of 75 feet. Changes/additions to the plans resulting from the TVMMWC Engineer's review shall be integrated and included in a subsequent.

TVMMWC

SUBMITTAL REQUIREMENTS FOR ALL HEC – 1 or HEC-HMS STUDIES

Submit the items listed under each category that applies to each HEC – 1 / HEC-HMS model run that is submitted.

1. HEC-1 / HEC-HMS print out with summary tables. The following information shall be on the cover of the print out:
 - Name of engineering firm who performed the study
 - Name of the project
 - Version of HEC-1 /HEC-HMS program
 - Date & time that the model was run
 - A statement if the model is pre-project or post-project
2. The computer model disk.
 - Disk must be clearly labeled
 - If more than one model file is on the disk, a listing and description of all files shall be included with the disk in an envelope
 - HEC-1 or HEC-HMS, HEC-2 or HEC-RAS files shall be submitted on separate disks
3. TVMMWC's "Model Summary Worksheet" Pages 1-3 completed out for each HEC-1 / HEC-HMS run submitted and attached to the printout.
4. Drainage Shed map showing the following:
 - Outline of all subsheds used in the HEC-1 /HEC-HMS study
 - The label of each subshed as modeled in the HEC-1 /HEC-HMS study
 - The area of each subshed as used in the HEC-1 /HEC-HMS study
 - The location where each subshed merges with the next clearly marked
5. If the study compares pre-project to post-project HEC-1 /HEC-HMS models, the TVMMWC's summary sheets shall include a listing of all the types and the locations of changes made in the model.

TVMMWC HEC-1 MODEL SUMMARY WORKSHEET Page 3 OF 3

PRE-PROJECT TO POST-PROJECT CHANGES

This sheet shall be completed if this HEC-1 / HEC-HMS study is used to compare pre-project to post-project runoff.

Name of pre-project HEC-1 /HEC-HMS study : _____

Run date _____

Basin's peak flow rate: Existing conditions _____

Post-development conditions _____

Has the pre-project study been approved by the TVMMWC? _____ **YES** If yes, when? _____
 _____ **NO**

Locations in	Types of change made
Example Shed-2S	Change earth-lined channels to drainage pipes and increased sub-shed area

TVMMWC

SUBMITTAL REQUIREMENTS FOR ALL HEC-2 or HEC-RAS STUDIES

**SUBMIT THE ITEMS LISTED UNDER EACH CATEGORY THAT APPLY TO EACH
HEC-2 or HEC-RAS MODEL RUN THAT IS SUBMITTED.**

1. HEC-2 or HEC-RAS print out with summary tables, The following information shall be on cover of the print out:
 - Name of engineering firm who performed the study
 - Name of project
 - Version of HEC-2 or RAS program
 - Date & time that the study was run
 - Statement if the study is pre-project or post-project
2. Provide the computer model on a 3-1/4" disk, CD-ROM, flash drive, or other suitable means.
 - Disk must be clearly labeled.
 - If more than one model file is on the disk, a listing and description of all files shall be included with the disk in an envelope.
 - HEC-1, HEC-2 or HEC-RAS files needs to be submitted on separate disks
3. TVMMWC's "Model Summary Worksheet" pages 1-3 filled out for each HEC-2 or HEC-RAS run that is submitted.
4. Water course map showing the following:
 - Lay out of the route of all water courses used in the HEC-2/RAS study.
 - All man-made structures with their type and size will be clearly marked and labeled (bridges, culverts, storm drain pipes, man-made channels, etc.).
 - Map of the locations and number of all cross-section used in study.
 - The starting HGL and peak flow rate for all storm frequencies modeled.
 - The location of where the flow rate changes and what the new flow rate is.
5. If the study compares pre-project to post-project HEC-2/RAS models, you shall include a summary sheet listing the locations and types of changes made between the models.

TVMMWC
HEC-2 / HEC-RAS MODEL SUMMARY WORKSHEET

Name of project: _____ Name of engineering firm who performed the study: _____ Contact person _____ Phone # _____ If this replaces a previous study, what is the name of that study _____
 This study reflects: Existing conditions Post-development conditions

If this HEC-2/RAS study is used to compare pre-project to post-project runoff what is the name of the study that you are comparing it with _____
 Run date _____

Has the pre-project study been approved by the city yes no
 If yes, name and when _____

Total length of water course (miles) _____ Total number of cross-sections _____

Name of Hydrology study used to get peak Discharge?

Design storm frequency: 2 yr 5 yr 10 yr 25 yr 50 yr 100 yr Other _____

The starting HGL _____
 Starting flow rate _____
 How was the starting HGL determined:

Give location of cross-sections where the flow rate changes and what the new flow rate(s) are.

START	10 YEAR	50 YEAR	100 YEAR

Floodplain Encroachment Compliance Statements

Improvements are being proposed within the 100-year floodplain of the TVMMWC.

These improvements are shown on the plans for:

The proposed plans for: _____

Designed by: _____

Dated: _____

A hydraulic study has been completed to show the hydraulic impacts of all of the improvements proposed within the floodplain shown on these plans. The title of this study is:

Title of hydraulic study: _____

Prepared by: _____

Dated: _____

I certify that I have looked at both the plans and the study and found that the improvements that are within the 100-year floodplain shown on the plans listed above are in conformance with the hydraulic study listed above and are accurately represented in the study.

Signed

R.C.E Lic. Number _____

Expires _____

SECTION 14

RECYCLED WATER INFRASTRUCTURE DESIGN

- 14-1 DETERMINATION OF USE** - The TVMMWC shall determine whether a given parcel or site will be furnished with recycled water or potable water for non-potable use. The determination shall be in accordance with the standards of treatment and water quality requirements for the proposed use. Guidelines are set in Title 22, Chapter 4 of the California Administrative Code, with the intent of the TVMMWC to protect the public health, and with the availability and/or feasibility of making recycled water available.
- 14-2 DESIGN INFORMATION** - Before design, the Developer, or his representative, should obtain the following from the Tesoro Viejo Master Mutual Water Company:
- A. Approval to use recycled water for the proposed system, as stated in the previous section.
 - B. Determination of on-site storage of recycled water will be required for peak demand use.
 - C. Verification of locations and size of proposed points of connection.
 - D. Design pressures and available flow to the proposed facilities.
- 14-3 CURRENT STANDARDS** - Pertinent and current requirements of the following agencies or standards shall be complied with. In case of conflicting design criteria, standards set forth by the Tesoro Viejo Master Mutual Water Company, as established herein, shall govern:
- A. Tesoro Viejo Master Mutual Water Company Rules and Regulations for use of recycled water.
 - B. Tesoro Viejo Master Mutual Water Company Design and Construction Standards
 - C. Title 22, Chapter 4 of the California Administrative Code regarding recycled water use.
 - D. Title 17, Chapter 5, Subchapter 1 of the California Administrative Code regarding cross-connections and backflow prevention.
 - E. Guidelines for Use of Recycled Water, State of California Department of Health Services.
 - F. Guidelines for Distribution of Non-portable Water, California – Nevada

Section, American Water Works Association (AWWA).

G. Manual of Cross Connection Control, State of California Department of Health Services.

H. Madera County Department of Environmental Health – regulations pertaining to recycled water.

I. California Regional Water Quality Control Board – Central Valley Regional waste discharge requirements order for TVMMWC, Madera County

14-4 RECYCLED WATER SUPPLY QUALITY - The Tesoro Viejo Master Mutual Water Company produces disinfected, tertiary-treated recycled water consistent with Title 22, Chapter 4 of the California Administrative Code.

14-5 OFF-SITE RECYCLED WATER FACILITIES - Normally consists of those facilities which are or will be owned, operated, and maintained by the Tesoro Viejo Master Mutual Water Company.

14-6 PRIVATE ON-SITE RECYCLED WATER FACILITIES - Facilities downstream of a recycled water meter owned, operated, and maintained by the property owner. The on-site recycled water facilities shall be subject to rules and regulations set forth by the TVMMWC for recycled water.

14-7 WATER SUPPLY PRESSURE - Minimum operating pressure of 35 PSI shall be maintained at service connections to the distribution system.

14-8 PEAKING FACTORS – The average day demand to maximum day demand peaking factor shall be 2.0. The average day demand to peak hour demand shall be 2.6.

14-9 TRANSMISSION SYSTEM DESIGN - Sizing and layout of transmission mains shall conform to the Recycled Water Master Plan of the Tesoro Viejo Master Mutual Water Company and as outlined herein.

A. Hydraulic Analysis – A Hardy-Cross network hydraulic analysis shall be provided to the TVMMWC upon request.

- 1.** The hydraulic analysis submitted shall include two copies of the following items:
 - a.** The data input files, as well as the analysis results on electronic format.
 - b.** Information on the development (e.g. type of development, number of acres, number of units, etc.).

- c. Data sheets outlining all assumptions including, but not limited to, method used to assign demands to corresponding junction nodes, proposed irrigation demands, and source HGL's used.
 - d. Map identifying pipe and node numbers and their locations.
 - e. The name and version of software used for the analysis.
 - f. Elevations of junction and source nodes. (The elevations used in the network hydraulic analysis shall be based on a project grading plan or the anticipated final elevations. If the final grading plan deviates significantly from the elevations used in the analysis, a revised analysis will be required.)
 - g. Staging or phasing of the development.
 - h. Appropriate off-site demands.
 2. The Hazen-Williams formula shall be used in the analysis of the system. The roughness factor shall be as follows:
 - a. $C=130$ for all cement-lined, PVC C-900/C-905, and ductile iron pipes greater or equal to 14 inches in diameter.
 - b. $C=120$ for all existing and new cement-lined, PVC C-900, and ductile iron pipes less than or equal to 12 inches in diameter.
- B. Specifications** - Technical specifications for transmission mains shall be submitted with improvement plans.
- C. Transmission Main Size** - All transmission mains shall be sized to provide total peak demand of all customers served. Peak demand flow is determined as follows:
1. Peak day demand for irrigation customers shall be determined as a July day demand.
 2. Peak demand flow for customers with on-site storage shall be peak day as a constant flow rate over a 24-hour period
 3. Peak demand flow for customers without on-site storage shall be no less than peak day as a constant flow rate over a 9-hour period. Maximum design velocity in the transmission and distribution systems shall not exceed 5 feet per second. Standard acceptable pipe sizes are 6, 8, 12, 18, 24, 30, and 36 inches.
- D. Transmission Main Location** - All transmission mains shall be

installed within public rights-of-way and easements. In every instance where a recycled water main is to be installed in a public right-of-way or easement, the TVMMWC Engineer shall be contacted for preferred location.

- 1.** Mains shall be located 8 feet from the curb and gutter on the northerly and westerly side of the street unless approved by the TVMMWC Engineer. If conflicts exist at this location, then the main may be installed within an easement immediately adjacent to and behind the property line fronting the public right-of-way, subject to approval of the TVMMWC Engineer.
- 2.** If it necessary to install a recycled water main outside of the public right-of-way, an easement dedication to the TVMMWC shall be required. Recycled water mains shall be centered within their easement. Easements shall be located completely on one side of a property line or fence. Dedicated easements shall be clear of all permanent structures, building eaves, roof lines and the future trucks of large tree species. Temporary construction easements of adequate size shall also be provided. The easement width shall be the greater of the following:
 - a.** Minimum width of easement shall be 15 feet.
 - b.** All easements shall have a minimum width equal to the required trench width according to the standard detail for trench backfill plus 2 additional feet of width for every 1 foot of depth of the pipe as measured from bottom of the pipe to finish grade. All recycled water lines shall be centered within their easement.
- 3.** Recycled water mains located between lots shall require an access easement or pedestrian walkway as determined by the TVMMWC Engineer.
- 4.** Recycled water mains shall maintain a minimum horizontal separation of 6 feet between sanitary sewer lines and 4 feet between potable water mains. Recycled water mains shall be higher than sewer mains and below water mains. On crossings, the recycled water line shall be a minimum of 1 foot above the sewer line and 1 foot below water mains unless approved by the TVMMWC Engineer. In cases where the recycled water main must cross under the sewer main or service, or over water mains, the recycled water line shall be ductile iron to a point 5 feet each side of crossing and be concrete-encased.
- 5.** When crossing a sanitary sewer force main, the recycled water main shall be installed a minimum of 1 foot above the sewer line, and be of ductile iron a minimum of 5 feet on each side of the force main.
- 6.** No parallel utilities shall be placed within 4 feet of each side of a

recycled water line.

7. Mains shall maintain a minimum cover of 36 inches and a maximum depth of 60 inches as measured from gutter flowline, unless otherwise specified by the TVMMWC Engineer.
 8. Recycled water mains shall maintain vertical separation of 12 inches between storm drains and other dry utilities. The vertical clearance may be reduced to 6 inches with the approval of the TVMMWC Engineer.
 9. Recycled water mains under large structures such as culverts and large diameter storm drains shall be ductile iron and installed within a casing per these standard unless approved by the TVMMWC Engineer. The casing shall extend beyond the structure a minimum of 5 feet or the depth of the water main on each side of the structure.
- E. Main Line Fittings and Connections** - Recycled water transmission and distribution systems shall be designed with mechanical restraint systems to prevent thrusting forces unless approved by the TVMMWC Engineer. All fittings shall maintain a minimum of 18 feet of restrained pipe into the fitting in all directions. Thrust blocks shall only be used in special cases where approved by the TVMMWC Engineer. All restrained joint systems shall be shown in plan and profile and on the master recycled water plan. Design of restrained systems shall follow standard engineering practice. The TVMMWC Engineer shall approve the design prior to installation. Any deviation from these requirements will not be permitted without approval of the TVMMWC Engineer.
- F. Valves** - The distribution system shall be equipped with a sufficient number of valves so that no single shutdown will result in isolating a transmission main. Valves shall also be spaced at intervals no greater than 2,500 feet. Valves shall be located such that any section of main can be shut down without going to more than three locations to close valves. All tees shall have two valves and all crosses shall have three valves minimum. A valve shall be installed on services immediately off the main and on the transmission main immediately downstream of the service.
- G. Booster Pump Stations** - All booster pumps stations shall be subject to criteria established and approved by the TVMMWC Engineer.
- H. Air and Vacuum Valves and Blow-Offs** - Air and vacuum valves shall be installed at all localized high points in the transmission main per standard drawings. A blow-off assembly, conforming to the Standard Drawings, shall be installed on all permanent and temporary dead-end runs, as well as each local low point on the transmission main unless approved by the TVMMWC Engineer. Wherever possible, the blow-off shall be installed in the street right-of-way a minimum of 5 feet from

the curb and gutter. In no case shall the location be such that there is a possibility of back-siphon into the distribution system. A 2-inch blow-off shall be used on mains 12 inches and smaller. A 4-inch blow-off shall be used on lines 16 inches and larger. Blow-offs shall be located within 100 feet of a sewer manhole, or other suitable discharge point, for discharging during servicing.

- I. Corrosion Protection** – A corrosion protection study shall be included with improvement plan submittals. Corrosion protection facilities shall be identified from the roadway with the curb stamp “CP-RW”

- J. Warranty Inspection of Recycled Water Stubs:** As a requirement, recycled water stubs are provided to subdivision, existing lots, or parcels, as a courtesy by developers during the construction of backbone infrastructures in streets to prevent cutting up the newly paved streets when the subdivisions are ready to develop. These stubs become an integral part of the recycled water system of the subdivisions, existing lots, or parcels, and subsequently the responsibility of the developers of the subdivisions, existing lots, or parcels, and are therefore subject to both construction and warranty inspections. This practice saves future developers construction time and cost that would have otherwise been spent on tie-ins and street repairs and in some instances prevents delays in the event a street has a moratorium. Since these stubs are provided at no cost to future developers, it is our position, hence our policy, that it is the responsibility of contractors to test and repair these stubs, if found damaged, prior to tie-ins. A note to this effect shall be placed on the improvement plans.

14-10 SERVICE LINES - Service lines from the recycled water main to the property line or edge of easement shall normally be installed at the time the main is constructed. Services from mains installed in private roads shall extend 2 feet beyond the edge of the pavement. Service line criteria shall be as follows:

- A.** For customers with on-site storage, service lines shall be sized to provide peak day demand as a constant flow rate over a 24-hour period. Service size subject to approval of the TVMMWC Engineer.

For customers where no on-site storage is required (as determined by the TVMMWC Engineer), larger service lines shall be provided subject to approval of the TVMMWC Engineer.

Maximum design velocity in service lines larger than 4 inches shall not exceed 5 feet per second.

- B.** All services shall be installed with a corporation stop at the main and a curb stop at the property line. A gate valve shall be used when the service is

larger than 2 inches.

- C. The TVMMWC Engineer reserves the right to make all recycled water service taps into existing mains upon application for a permit and payment of the required fees. A note to this effect shall be placed on the plan sheet, which details the area that requires such tapping. Application shall be made to the TVMMWC at least two weeks in advance of the time the tap is desired. All fees shall be paid prior to application. The Contractor shall do all excavation, backfill and the installation of the remainder of the recycled water service.
- D. Location of each service line will be determined on a case-by-case basis by the TVMMWC Engineer.
- E. Separation of recycled water services, sanitary sewer lines, and potable water lines are described in these standards.
- F. Meters shall be installed on all recycled water services. TVMMWC staff shall install meters after permits are processed, testing has been completed per the construction standards, and fees are paid.
- G. The curb shall be stamped with a “RW” at service locations.

14-11 ON-SITE RECYCLED WATER FACILITIES DESIGN - On-site recycled water facilities are defined as those facilities which are owned and operated by private entities. All potential on-site uses of recycled water shall be reviewed by the Tesoro Viejo Master Mutual Water Company Engineer. If recycled water is to be used, the facilities shall be designed and constructed in accordance with the provisions set forth herein (Sections 14-10 through 14-23) for on-site recycled water facilities. Where a unique situation exists on-site that is not covered by on-site specifications, off-site specifications may apply as determined by the TVMMWC Engineer. In addition, all state and county regulations regarding recycled water use shall be incorporated. Potential uses of recycled water are outlined in Title 22, Chapter 4 of the California Administrative Code. The following notes shall be placed on the improvement plans, and landscape design plans:

**Tesoro Viejo Master Mutual Water Company Recycled Water
Special On-Site Irrigation Notes**

1. The installation of the recycled water system shall conform to the regulations for the construction of recycled water systems within the Tesoro Viejo Master Mutual Water Company and the accompanying plans and specifications.
2. All on-site recycled and potable water piping installed on this project shall be identified in accordance with the Tesoro Viejo Master Mutual

Water Company Construction Standards for recycled water infrastructure and the irrigation specifications.

3. Tesoro Viejo Master Mutual Water Company shall be notified two days prior to the start of construction at (559) 853-4505 and each workday thereafter until completion of project for commercial irrigation systems. Tesoro Viejo Master Mutual Water Company shall be notified two days prior to the start of construction at (559) 853-4505 for landscape corridors and parks. A pre-construction materials inspection must be arranged prior to the start of construction.
4. No facility is to be backfilled until inspected by the Tesoro Viejo Master Mutual Water Company Engineer.
5. All recycled water infrastructure, both on-site and off-site, shall be inspected by Tesoro Viejo Master Mutual Water Company. For inspection of recycled water system contact the TVMMWC at (559) 853-4505 forty-eight (48) hours in advance. Points of inspection are:
 - a. Pre-construction materials inspection.
 - b. Irrigation system installation before lines are covered.
 - c. Pressure testing.
 - d. System cross connection control test.
 - e. System coverage test.
6. All recycled water piping shall be purple colored PVC unless otherwise specified. Where purple PVC is not used, pipe shall be identified (marked) in accordance with the Tesoro Viejo Master Mutual Water Company Construction Standards.
7. Marking on the purple colored PVC pipe shall include the following:

“CAUTION: RECYCLED WATER- DO NOT DRINK”. Nominal pipe size. PVC-1120. Pressure rating in pounds per square inch at 73 degrees. ASTM designations such as 1785, 2241, 1672, 3139. Printing shall be placed continuously on two sides of the pipe.
8. All recycled water sprinkler control valves, valve risers, sprinkler risers, and swing joints shall be tagged with identification tags or adhesive labels.
 - a. Tags shall be weatherproof plastic, 3” x 4”, purple color with the words “WARNING: RECYCLED WATER - DO NOT DRINK” imprinted on one side, and “AVISA: AGUA IMPURA-NO TOME” on the other side. Imprinting shall be permanent and black in color. Use tags as manufactured by T. Christy Enterprises or approved equal.
 - b. One tag shall be attached to each valve as follows:

1. Attach to valve stem directly or with plastic tie-wrap; or,
 2. Attach to solenoid wire directly or with plastic tie-wrap.
- c. Recycled water warning labels or stickers that are consistent with Tesoro Viejo Master Mutual Water Company Construction Standards for recycled water infrastructure and the irrigation specifications must be attached to all piping not in compliance.
 - d. All sprinkler heads must be designed for recycled water usage, with purple recycled water warning caps.
 - e. Sprinkler risers and swing joints shall be identified with purple adhesive 3" x 3" labels. Each label shall state "Recycled Water – Do Not Drink" in English and Spanish.
9. All recycled water control valve boxes shall be purple and have a warning label permanently molded into or affixed onto the lid with rivets, bolts, etc. Warning labels shall be constructed of a purple weatherproof material with the warning permanently stamped or molded into the label. The warning shall contain the following information:
- a. "NON-POTABLE" or "RECYCLED WATER".
 - b. "DO NOT DRINK" in English and Spanish.
10. Recycled water quick coupling valves shall have a purple rubber or vinyl cover. The cover shall be of a locking type and have a warning permanently stamped or molded as follows: "RECYCLED WATER – DO NOT DRINK" in English and Spanish.
11. Plastic warning tape shall be used on all non-potable water piping; non-potable water warning tape shall be a minimum of 3 inches wide and shall run continuously for the entire length of each line. The tape shall be attached to the top of the pipe with nylon tie-wrap banded around the warning tape and the pipe every five feet on center. Warning tape for the non-potable water piping shall be purple in color with words "CAUTION: NON-POTABLE WATER LINE BURIED BELOW" imprinted in minimum 1- inch high letters, black in color. Imprinting shall be continuous and permanent.
12. All pressure main line piping from the recycled water system shall be installed to maintain 4 feet minimum horizontal separation from all potable water piping. Where recycled and potable water pressure main line piping cross, the recycled water piping shall be installed 12" below the potable water piping OD to OD unless approved by the TVMMWC Engineer. Where the recycled water pressure main line must pass above potable water piping, the recycled water piping shall be installed in a class 200 purple colored PVC sleeve which extends a minimum of five

feet on either side of the potable water piping. A 12” vertical separation OD to OD must be maintained unless approved by the TVMMWC Engineer.

Conventional (white) PVC pipe may be used for sleeving material if it is taped with three-inch wide purple warning tape, which reads “RECYCLED WATER-DO NOT DRINK”, or equivalent.

- 13.** All pressure main line piping from the recycled water system shall be installed to maintain a six foot minimum horizontal separation from all sanitary sewer lines. Where recycled and sewer cross, the recycled water piping shall be installed a minimum of one foot above sewer unless approved by the TVMMWC Engineer.
- 14.** For on-site recycled water piping, the minimum depth from finish grade to top of pipe shall be as follows:
 - a.** Intermittent pressure lines (All sizes)..... 12”
 - b.** Constant pressure lines 2.5” and smaller..... 18”
 - c.** Constant pressure lines 3” and larger24”
- 15.** Pressure and cross connection testing for On-Site Recycled water systems:
 - a.** All testing of recycled water systems must be performed utilizing a potable water source via a construction water connection per Tesoro Viejo Master Mutual Water Company Construction Standards. No recycled water may connect to a recycled water system until all testing is successfully complete.
 - b.** The source of potable water used for testing must have a meter and an approved back flow prevention device. These can be obtained through the Tesoro Viejo Master Mutual Water Company.
 - c.** The contractor shall provide a means to plumb in pressure and cross connection testing apparatus at the point of highest elevation, for both potable and constant pressure recycled water systems.
 - d.** The constant pressure recycled water system including all appurtenances shall be tested at 150 PSI at highest point of elevation for 1 hour with no detectable leakage.
 - e.** Pressure testing must be successfully completed prior to cross connection testing.
 - f.** The recycled water system shall be tested for cross-connection in accordance with Uniform Plumbing Code Appendix J prior to use.

- g.** For projects being performed in phases, a cross connection test shall be performed on each phase independently before it is put into service. The potable water source used for testing each phase must be independent of other previously completed phases.
- h.** At the time a cross connection test is to be performed, construction on both the potable and the recycled water systems being tested must be complete, and both systems fully operational and functioning as designed.
- i.** Cross connection testing shall be performed on the system by TVMMWC forces with the assistance of the Contractor. The test will be coordinated through the TVMMWC inspector. Forty-eight (48) hours notice is required before the test. Depending on the complexity of the site, a preliminary field meeting may also be required.

16. Coverage test

- a.** Adjust spray heads to eliminate overspray onto native oak areas and into areas not under the control of the customer such as pool decks, private patios, streets, sidewalks, and other similar facilities.

17. Meter Installation

Once the on-site recycled water system has been properly inspected and passed pressure and cross connection testing, a meter may be installed. The meter must be purchased from the Tesoro Viejo Master Mutual Water Company and installed by TVMMWC forces. Coordinate meter purchase and installation with the TVMMWC inspector.

- 18.** No connection shall be made to the TVMMWC's existing recycled water system until the new facilities have been successfully pressure and cross connection tested. Taps to the existing recycled system will be made by TVMMWC forces only.

- 19.** Failure to comply with the above guidelines violates the Tesoro Viejo Master Mutual Water Company design and construction standards for recycled water infrastructure and will result in termination of service until the appropriate corrective steps have been taken.

14-12 DETERMINATION TO USE RECYCLED WATER OR POTABLE

WATER - The TVMMWC shall determine whether a given parcel or site will be furnished with recycled water or potable water for non-potable use. The determination shall be in accordance with the standards of treatment and water quality requirements for the proposed use. Guidelines are set in Title 22, Chapter 4 of the California Administrative Code, with the intent of the TVMMWC to protect the public health, and with the availability and/or feasibility of making recycled water available. Additionally, a determination

will be made whether the proposed use falls within the guidelines of the County's Master Reclamation Permit.

14-13 DESIGN OF RECYCLED WATER FACILITIES WITH TEMPORARY POTABLE WATER SERVICE - Where recycled water is not immediately available for use when the design area is ready for construction, and if the TVMMWC Engineer has determined that recycled water will be supplied in the future, the on-site facilities shall be designed to use recycled water. The on-site system shall be designed and constructed to the TVMMWC construction specifications as set forth herein. Provisions shall be made as directed by the TVMMWC and these specifications followed to allow for connection to the recycled water facilities when they become available. In the interim, potable water will be supplied to the recycled water facilities through a temporary potable water connection. Until recycled water is available, potable water rates will be charged as set forth in Section 14 of the TVMMWC Code. A backflow prevention device acceptable to the local Health Department and the TVMMWC will be required as long as the on-site facilities area uses potable water. The backflow prevention device shall be downstream of the meter and a part of the on-site facilities. When recycled water becomes available, the backflow prevention device will be removed and the recycled water connection to the on-site facility made.

14-14 BACKFLOW PREVENTION DEVICES - Single check valve backflow preventers shall be required on all recycled water services 1-1/2 inches in diameter and larger. The backflow preventer shall be installed per TVMMWC standards downstream of the meter. Backflows are not required on recycled water services utilizing booster pumps which incorporate a backflow preventer.

14-15 PROHIBITION AND LIMITATIONS - Design of on-site recycled water facilities shall conform to the following:

- A. The recycled water systems shall be separate and independent of any potable water system. Cross-connections between potable water facilities and on-site recycled water facilities are forbidden.
- B. Hose bibs on recycled water facilities are forbidden.
- C. Drinking fountains shall be protected from the spray of recycled water in a manner approved by the TVMMWC Engineer prior to installation.
- D. Overspray and run-off shall be limited or prevented.
- E. Potable and recycled lines are not to be installed in the same trench.
- F. Recycled water shall not be used for any purpose other than the approved uses as set forth herein.
- G. The system shall be designed to irrigate the design area within the allowable time periods as set forth herein.

14-16 CONTROL OF RUN-OFF AND APPLICATION AREAS –

The TVMMWC encourages new and innovative methods of irrigation. The use of drip or subsurface irrigation may prove effective in the reduction of total water consumption and control of unnecessary run-off by containment of the water to the design area. In accordance with these requirements for control of run-off and for control of the areas to which recycled water is applied, the design of irrigation systems shall conform to following:

- A.** The on-site recycled water facilities shall be designed to meet the peak moisture demand of all plant materials used within the design area. The use of moisture sensors is encouraged.
- B.** On-site recycled water facilities shall be designed to prevent discharge onto areas not under control of the customer. Semi-circular sprinklers shall be used adjacent to roadways and property lines to confine the discharge from sprinklers to the design area.
- C.** The design of the on-site recycled water irrigation facilities shall provide for watering during periods of minimal use of the service area. All on-site recycled water irrigation systems shall be designed to operate between the hours of 9:00 PM and 6:00 AM unless otherwise directed by the TVMMWC Engineer.
- D.** The total time required to irrigate the design area shall not exceed nine hours in any 24-hour period. Irrigation systems shall be designed to operate within this time requirement.
- E.** Recycled water shall be applied at a rate that does not exceed the percolation rate of the soil. Where varying soil types are present, the design of the recycled water facilities shall be compatible with the lowest infiltration rate present. Copies of the Developer's soils test reports shall be made available to the TVMMWC upon request.

14-17 MINIMUM DEPTH TO TOP OF ON-SITE RECYCLED WATER PIPING - For on-site recycled water piping, the minimum depth from finished grade to top of pipe (minimum cover) shall be as follows:

- A.** Constant pressure lines 3 inches and larger: 24 inches
- B.** Constant pressure lines 2-1/2 inches and smaller: 18 inches
- C.** Intermittent pressure lines excluding drip tube: 12 inches

Where piping is under paved areas, these dimensions shall be considered below sub grade, or the bottom of lime treated subgrade is applicable.

14-18 DATA REQUIRED ON PLANS - The following information shall be included on all improvement plan sets for projects with recycled water facilities:

A. Meter Data - All recycled water services shall be metered. The following information shall be supplied for each recycled water meter desired; information is to be provided and shown at each meter location.

1. The meter location (distance from property lines) and size (inches); meter address.
2. The peak flow through the meter (gpm).
3. The (static) design pressure at the meter (PSI).
4. The total area served through the irrigation meter in square feet or acres.
5. An estimate of the yearly water requirement through the meter (acre-feet).

B. Drinking Fountains - Exterior drinking fountains must be shown and called out on the recycled water system plans. If no exterior drinking fountains are present in the design area, it must be specifically stated on the plans that none exist. The potable water lines supplying the drinking fountain must have an identification tape installed as provided in the Construction Standards. All existing and proposed potable water lines within the area of recycled water lines must be shown on the recycled water system plans calling out all required separations. Drinking fountains must be protected from the direct spray of recycled water either by proper placement of the drinking fountain within the design area or the use of a covered fountain approved for this purpose.

C. Irrigation Equipment Legend - For irrigation systems, a legend showing the pertinent data for the materials used in the system shall be recorded on the plans. The legend shall include a pipe schedule listing pipe sizes, a listing of valve types including quick-coupling valves, and the following information for each type of sprinkler head:

1. Sprinkler radius (feet).
2. Operating pressure (PSI).
3. Flow (gpm).
4. Sprinkler pattern.

D. Recycled Water Warning/Information Sign - Recycled water

warning/information signage locations shall be shown on the recycled water system plan. Signs shall be located at all access points to the area of recycled water use. Signs shall also be placed along frontage roads at intervals of every 500 feet or less. The signs shall be installed in accordance with the Construction Standards herein and as required by the TVMMWC Engineer.

- 14-19 LOCATION** - All pressure main line piping from the recycled water system shall be installed to maintain a 6-foot minimum horizontal separation from all potable water piping. Where recycled and potable water pressure main line piping cross, the recycled water piping shall be installed below the potable water piping in a Class 200, purple-colored PVC sleeve which extends a minimum of 5 feet on each side of the potable water piping. Provide a minimum vertical clearance of 12 inches unless approved by the TVMMWC Engineer.

All pressure main line piping from the recycled water system shall be installed to maintain a 6-foot minimum horizontal separation from all sanitary sewer lines. Where recycled and sewer lines cross, the recycled water piping shall be installed a minimum of 1 foot above the sewer unless approved by the TVMMWC Engineer.

- 14-20 PLAN SUBMITTAL AND APPROVAL** - Plans with recycled water systems, public and private, shall be submitted to the TVMMWC for review and approval prior to construction. A signature block shall be placed on the cover sheet for TVMMWC Engineer signature.

- 14-21 INSPECTION** - The TVMMWC shall inspect the construction of on-site facilities per the Construction Standards for recycled water. Notification shall be made two working days in advance of construction by the applicant, owner, or customer. The TVMMWC shall be called for inspection at (559) 853-4505.

- 14-22 RECORD DRAWINGS** - Record or "As Built" drawings shall be prepared and shall show all changes in the work constituting departures from the original contract drawings including those involving both constant-pressure and intermittent-pressure lines and appurtenances. All conceptual or major design changes including any changes that may be affected by the requirements of these standard specifications shall be approved by the TVMMWC before implementing the change in the construction contract. Failure to receive prior approval may result in termination of service.

Upon completion of each increment of work, all required information and dimensions shall be transferred to their record drawings. Facilities and items to be located and verified on the record drawings will include, but are not limited to the following:

- A. Point of connection.
- B. Routing of sprinkler pressure lines.
- C. Routing of all potable water lines both existing and proposed.
- D. Gate valves.
- E. Sprinkler control valves.
- F. Quick-coupling valves.
- G. Routing of control wires.
- H. Other related equipment as specified by the TVMMWC or the owner.
- I. Sprinkler head manufacturer and model number.

Changes and dimensions shall be recorded in a legible and workman- like manner. Record construction drawings shall be maintained at the job site during construction. The applicant, owner, or customer shall provide a complete set of as-built mylar drawings to the TVMMWC upon completion of construction. The applicant will also provide as-builts on diskette in .DWF or .DWG electronic format upon request and a PDF set.

Prior arrangements must be made with the TVMMWC if water service is to be provided prior to as-built blue line submittal. Failure to provide record drawings will result in termination of service.

14-23 CONTROLLER ACCESS - The Tesoro Viejo Master Mutual Water Company reserves the right to have complete access to the controller clocks, for reasons of monitoring and controlling system failures. The applicant, owner, or customer shall provide the TVMMWC with two sets of all keys necessary for access to the controller clocks within the design area. The keys will then become the property of the TVMMWC. The TVMMWC is not responsible for loss or damage to any controller.

14-24 BLOW-OFFS AND OTHER POINTS OF PUBLIC ACCESS – All on-site recycled water facilities shall be restricted from public access so that the general public cannot draw water from the system. Facilities, blow-offs on strainers, and other such facilities, shall be restricted from public access.

These facilities, both above and below grade, shall be housed in an approved lockable container colored purple. A sign reading “CAUTION: RECYCLED WATER – DO NOT DRINK” shall be installed in accordance with the Construction Standards herein. The TVMMWC shall approve its

size. An alternative acceptable means of restricting public access is the use of valves that operate by means of a recessed key slot or by means of hexagonal heads (such as those typically found on fire hydrants). Other means of restricting public access must be approved by the TVMMWC.